World Petroleum

JULY 1952

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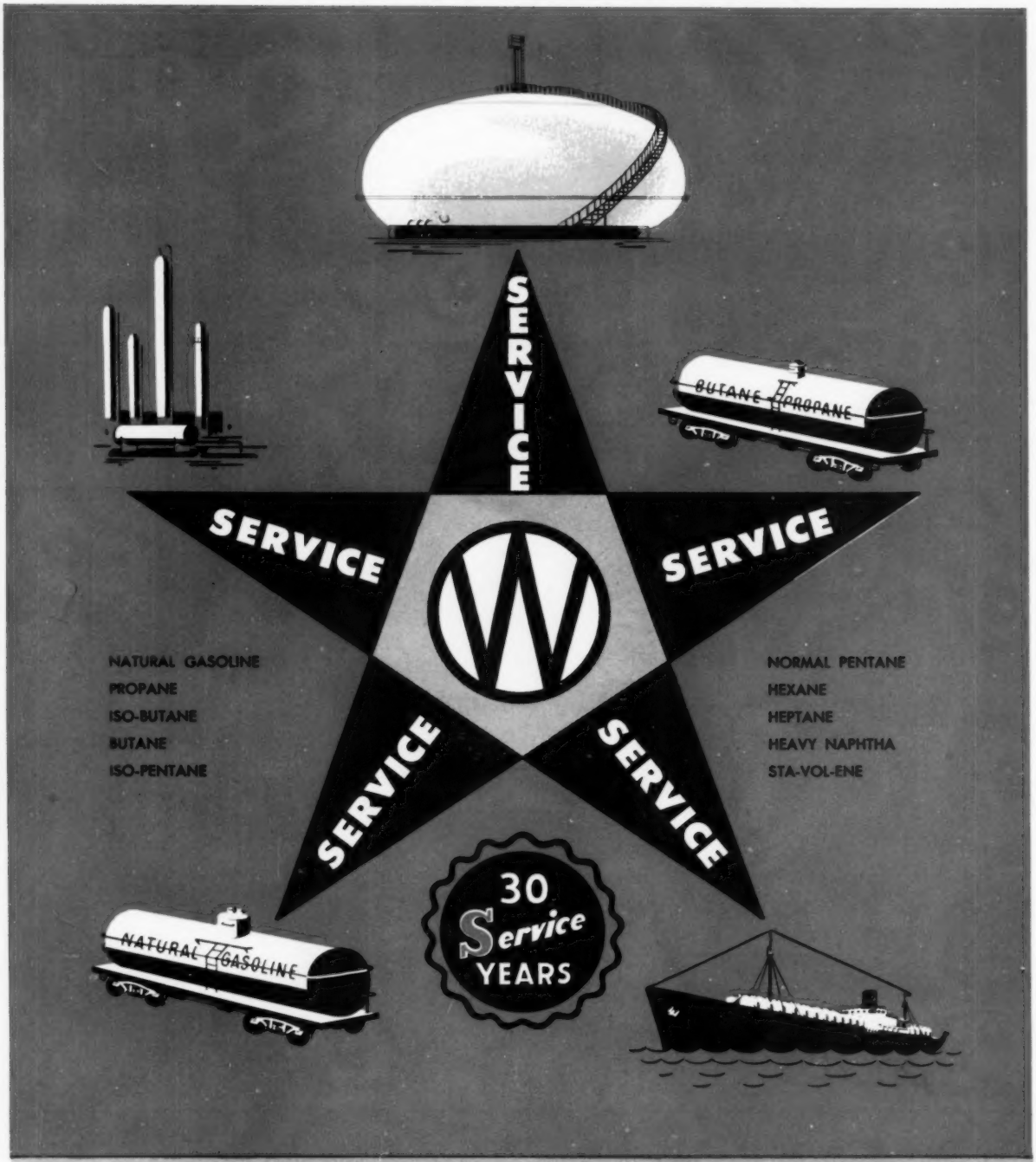

WARREN

PETROLEUM CORPORATION

TULSA, OKLAHOMA CABLE ADDRESSES: Stavolene, Warren

EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN, TEXAS CITY AND WARRENGAS, HOUSTON, TEXAS

"Putting the Pressure On"

VOLATILE LIQUIDS

with HORTONSPHEROIDS

Volatile liquids suffer excessive evaporation loss when stored in tanks at atmospheric pressure. Evaporation not only reduces the volume, but quality of the product may also be effected. To prevent this from happening, tanks built to withstand internal pressure are used . . . and when it comes to "putting the pressure on" volatile liquids, Hortonspheroids have proven superior.

Hortonspheroids do not vent under normal standing conditions. As long as internal pressures do not exceed the setting of the relief valves, no loss of vapor can take place. Pressure storage also reduces evaporation losses of products that will boil at atmospheric pressure.

The distinctive shape of the Hortonspheroid results in a minimum amount of steel. An ideal shape for storing liquids under pressure, the Hortonspheroid utilizes the steel with great efficiency to effectively resist liquid and gas pressures.

Further information concerning Hortonspheroids and pressure storage can be obtained by writing the nearest office. There is no obligation on your part.

The Hortonspheroids in the above views are located at a refinery with a charging capacity of 50,000 bbls. per day. It has 195 tanks with a total capacity of 1,653,000 bbls. operating at atmospheric pressure and a total capacity of 75,000 bbls. for storing volatile petroleum products under high pressure.

CHICAGO BRIDGE & IRON COMPANY

Chicago • Houston • Tulsa • San Francisco • Birmingham • Atlanta • Cleveland • Philadelphia • Los Angeles • Boston • Seattle • Detroit • Washington
Plants: Birmingham, Chicago, Salt Lake City and Greenville, Pa., U.S.A. Export Office—165 Broadway Building, New York 6, N. Y., U.S.A.

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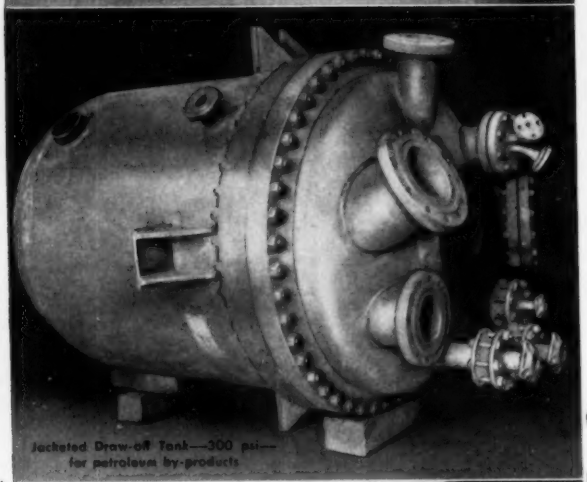
Sociedade Chibridge de Construcoes Ltda., Av. Franklin Roosevelt, 194-S/704 C, Rio de Janeiro, Brazil

Two Quench Pots 3' x 21'6"—35 psi—
for petrochemicals



Jacketed Draw-off Tank—300 psi—
for petroleum by-products

Processing plants today increasingly require specially designed pressure vessels. Graver has long been expert in the fabrication of code vessels, whether API-ASME, ASME or even more stringent specifications set by customers. Graver-built pressure equipment assures long life and safe, dependable service.

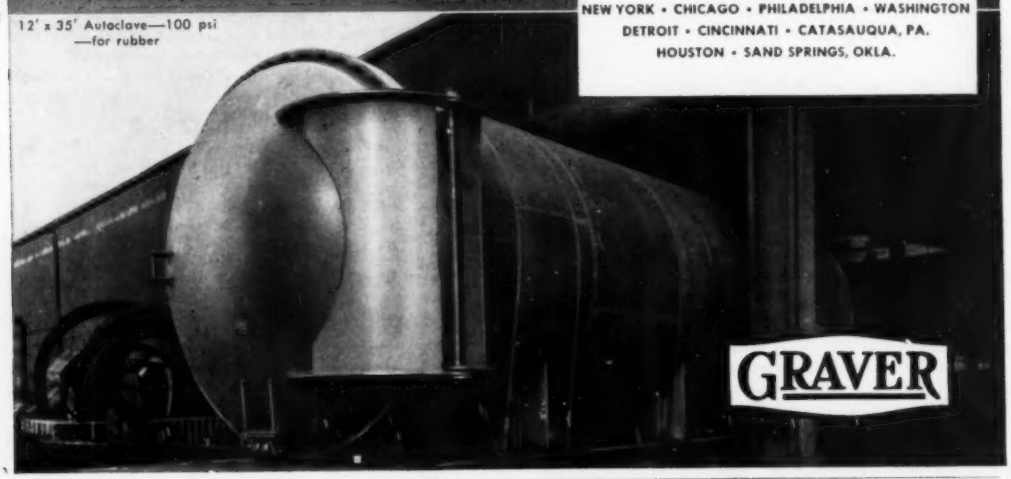
The steady flow of steel, clad and alloy pressure vessels through Graver's plants is suggested by these shop views. They indicate the many skills and services obtainable through Graver's high standards of welding craftsmanship.

GRAVER TANK & MFG. CO., INC.

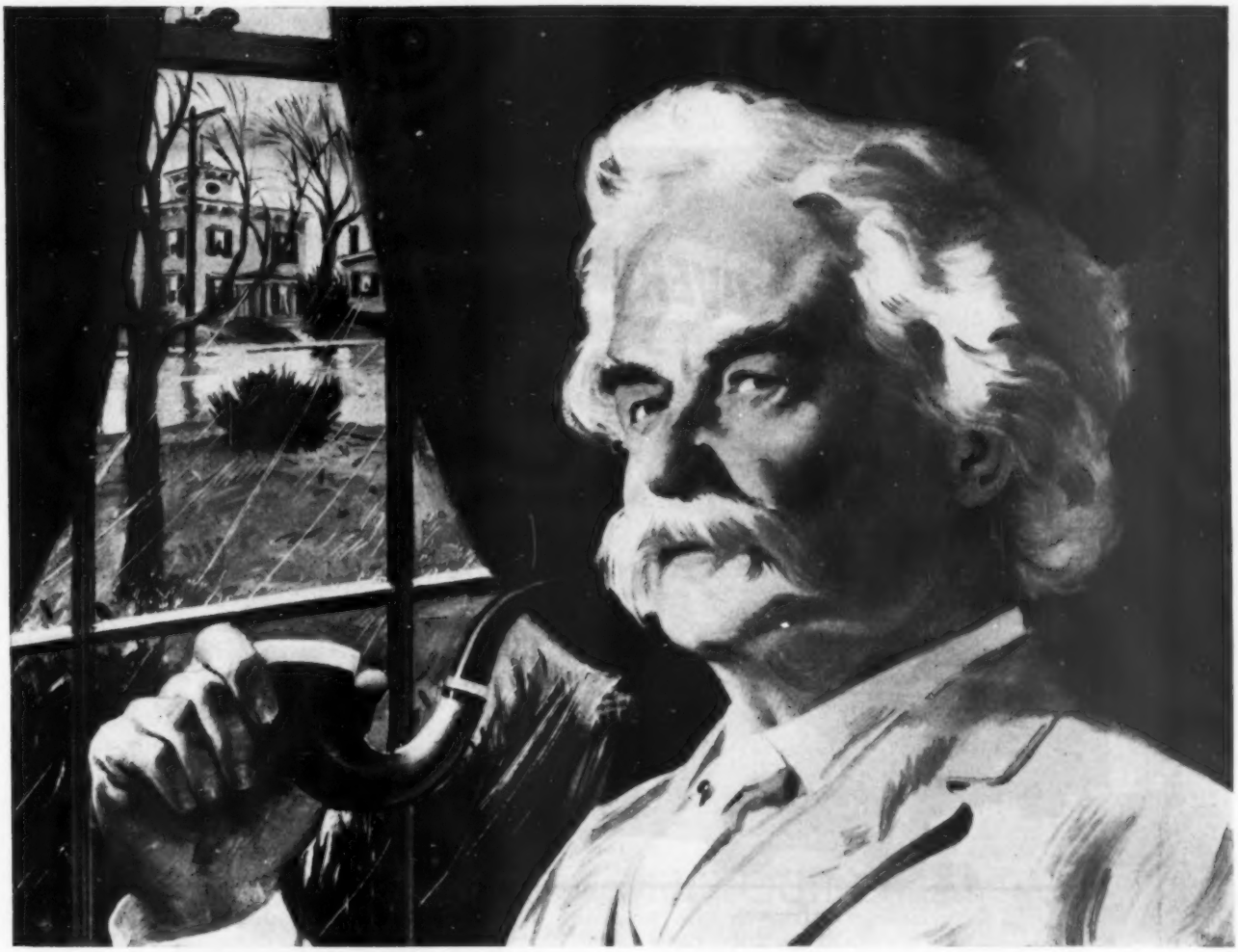
EAST CHICAGO, INDIANA

NEW YORK • CHICAGO • PHILADELPHIA • WASHINGTON
DETROIT • CINCINNATI • CATASAUQUA, PA.
HOUSTON • SAND SPRINGS, OKLA.

12' x 35' Autoclave—100 psi
—for rubber



WORLD PETROLEUM for July, 1952. Vol. 23, No. 7. July, 1952. WORLD PETROLEUM is published monthly by Mona Palmer, Trustee under the will of Russell Palmer, 2 West 45th St., New York 36, N. Y. Acceptance at East Stroudsburg, Pa., under Section 34.64 P. L. & R. Authorized. Subscription rate: $5.00 per year, single copies $1.00. Copyright, 1952, by Mona Palmer, Trustee.



You had something there, Mark Twain

We doubt if the beloved Mark Twain had gasoline refiners in mind when he was reported to have said:

"Everybody talks about the weather, but nobody does anything about it!"

But he certainly was hitting close to the problem which has for many years vexed refiners who wanted to obtain reliable road knockratings. There are hardly two days in a year when the same weather conditions are to be found...not to mention traffic variables. As a consequence, a day-to-day variation of four octane numbers was possible in the rating of a single fuel in a particular automobile. Fuel ratings obtained indoors on chassis dynamometers often were subject to considerable variation, and sometimes bore little relation to performance on the road.

This is not surprising, because of differences in atmospheric temperature and humidity, and failure of the equipment in the chassis dynamometer room to provide "wind" equivalent to that encountered in normal car operation.

So Ethyl research people did something about it. They built two unusual chassis-dynamometer rooms in which atmospheric temperature and humidity can be closely controlled. Furthermore, air velocity against the front of the car can be automatically controlled relative to the speed of the rear tires.

These two rooms constitute a flexible combination which can accommodate a wide range of automotive vehicles operated under substantially any combination of temperature, humidity and wind encountered in service.

Simulation of vehicle operation on the road is further assured by equipment which causes the acceleration and speed of the rear wheels to be the same as those on the road resulting from any movement of the foot throttle.

The next time you are in Detroit we shall be glad to show you these rooms. In the meanwhile, our descriptive brochure entitled "Road Knockratings Indoors with Ethyl's New All-Weather Rooms" is yours for the asking.

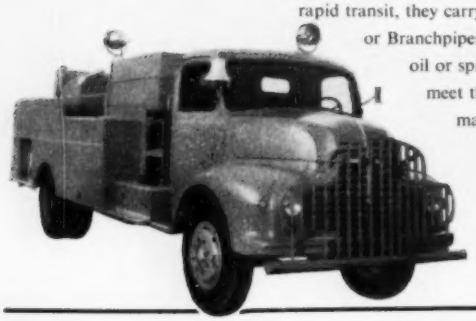
ETHYL CORPORATION, New York 17, N. Y.

Ethyl Antiknock Ltd., in Canada

ALL OVER THE WORLD

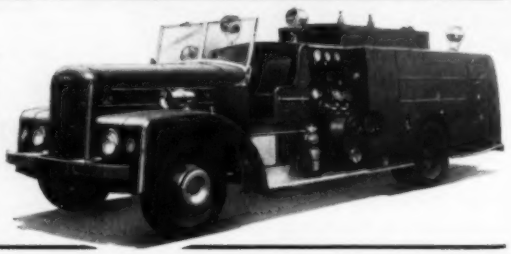
Pyrene FOAM TENDERS are protecting oil installations AGAINST FIRE

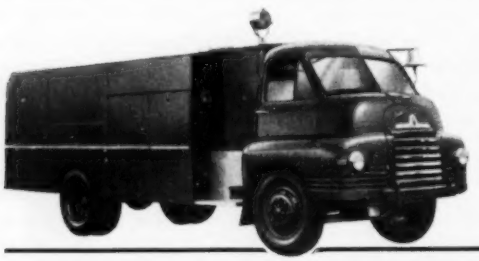
"Pyrene" Foam Tenders are universally recognised as the latest and most practical form of fire protection for Oil Tank Installations, Refineries and large Chemical Works. Designed for rapid transit, they carry their own foam compound supply, "Pyrene" Foam Generators or Branchpipes, a fire pump and all necessary equipment for extinguishing bulk oil or spirit fires. Each "Pyrene" Foam Tender is especially designed to meet the particular risks involved. The three models shown have been made to the requirements of leading Oil Companies.



With a foam tank of 500 imperial gallons capacity, this "Pyrene" Tender has an output of 5,600 imperial gallons of foam for approximately 20 minutes when connected to a hydrant. Equipment includes six "Pyrene" light-alloy Branchpipes (four F.B.10 size and two F.B.20 size), a Dennis 350/500 g.p.m. independent pump unit, hoses, collecting breechings and suction collection heads. The Leyland "Comet" chassis is powered by a 75 B.H.P. diesel engine.

This "Pyrene" Foam Tender is equipped with a tank holding 600 imperial gallons of "Pyrene" Foam Compound, two No. 20 and one No. 10 "Pyrene" Foam Generators, four F.B.10 portable Foam Branchpipes and a fire pump. This fire fighting vehicle is capable of producing 4,500 imperial gallons of foam per minute for 30 minutes without replenishment. Pump drive is by power take-off from the prime mover, a Rolls-Royce engine of 160 B.H.P.





This all-purpose Fire Fighting Tender carries not only 500 imperial gallons of foam compound, but its own "first-aid" water supply of 200 imperial gallons, six 50 lb. CO_2 cylinders, four 'Pyrene" No. 10 inline inductors, two fixed No. 10 "Pyrene" Mechanical Foam Generators and two portable No. 10 size Foam Generators. Other equipment includes First Aid Hosereel, hoses and nozzles. Pump drive is by power take-off from the vehicle's 110 B.H.P. Bedford engine.

Pyrene TRADE MARK FIRE FIGHTING EQUIPMENT

THE PYRENE COMPANY LIMITED

Write for full details to:— (Dept.W.P7.,) 9, Grosvenor Gardens, London, S.W.1.
Head Office and Works : Great West Road, Brentford, Middlesex.
Associated with :- Pyrene Manufacturing Company, Newark New Jersey, U.S.A. and Pyrene Manufacturing Company of Canada, Limited, Toronto, Ontario, Canada.

On a road paved with YOUR Dollars

A road twenty feet wide, carpeted with one dollar bills, extending 256,471 miles through space to the moon,--illustrates the astronomical magnitude of our Federal debt.

1932 was a bad year for most of us, whether we were in business, or looking for a job, or going to school.

1952 seems much better to the majority of our citizens, with increased business, high wages and a good education for the children.

But how much better off, really, are those of us who think "we're in clover"? Consider our National debt which has skyrocketed from 19 billion dollars to over 260 billion dollars in the past twenty years.

Such a figure is difficult to grasp. But it represents your debt, the amount that you and your family must pay. This debt is the obligation of every man, woman and child in the United States. The interest on this debt must be paid through taxes, and as the debt increases, the more our taxes will increase. If you have a wife and two children, your share of the Federal debt is now approximately $7,000.

Your debt is now 13 times what it was in 1932, and they're planning right now, down in Washington, to inflate it even more.

Do you like it? Is that what you want? If you don't like it and don't want further expansion of our Federal debt, it's up to you to let Washington know. Only when American citizens are aroused and speak up, by electing able and patriotic men to public office, will there be an end to this orgy of public extravagance.

YOUR SCRAP YOUNGSTOWN IS NEEDED

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

"...On the feet of Individuals."

Society advances on the feet of individuals. We Americans live under the highest standard ever achieved because we believe in and are permitted currently to practice three of the cardinal principles of progress—Invention, Research and COMPETITION.

Nineteen basic inventions influence our pattern of life today. Each one was created to satisfy a fundamental need for improvement—a modern means of competing as against outmoded procedure. Each one, such as the electric light, the telegraph, the amplifying tube, the induction motor, created a new industry in which numerous companies strove in free competition for the maximum share of business.

For example, since Thomas Edison invented the incandescent filament lamp in 1880, the electric light industry has grown to an annual volume of $501,500,000 in light bulbs alone; in May, 1906 the Wright Brothers received the patent for their flying machine; the value of aviation manufactures in 1951 in the United States alone was estimated at $3,350,000,000 and in February, 1952, records show a $10½ billion backlog of orders.

More rapid still is the growth of the radio-television industry which today produces some $230 million worth of home radio sets and $1,570,800,000 in television sets. In every case, employment and sales volume grew enormously and the public enjoyed huge personal benefits.

Side by side with Invention came Research, exemplified by the competition of intelligent men questing for new materials, new methods, new processes, new scientific truths. Current advertisements tell of hundred-year tests to assure better materials for the future, technology that produces metals to withstand almost inconceivable heat, machines calculating 20,000 times faster than the mind of man, medicines that cure "incurable" diseases, food processes that cook, sterilize and pack hundreds of cans a minute. And in every case, the public enjoys huge personal benefits.

This is what James A. Decker undoubtedly had in mind when he wrote the line, "Society advances on the feet of individuals." These "individuals" are you and I, all our countrymen, benefiting every day from Invention, Research—and from COMPETITION.

Developing inventions, marketing products, and pursuing scientific research require substantial investments. A grave danger to their future now looms. In 1951, corporation net profits suffered a loss of 21% over the previous year. The reason—taxes too high, government controls and policies that interfere too greatly with private industry. If this continues, financial resources will dwindle, competition will be stifled.

Without free competition, American progress stops. No country can long exist when its government calls all the shots. We need competition to assure progress for people.

★ ★ ★

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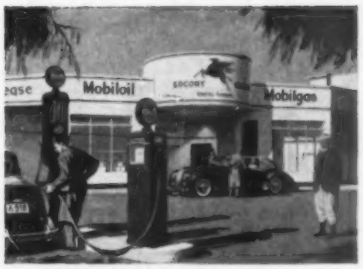
THE COMPETITIVE SYSTEM DELIVERS THE MOST TO THE GREATEST NUMBER OF PEOPLE

Mobilgas
SOCONY-VACUUM

THE SIGN THE NATION KNOWS—

Known Round the World, too!

Mobilgas—America's largest seller—is a *world-wide* favorite, too! The reason is *Flying Horsepower*—result of the industry's foremost catalytic refining program. Socony-Vacuum was the pioneer in catalytic cracking—today leads in construction of this most modern type of refining equipment.



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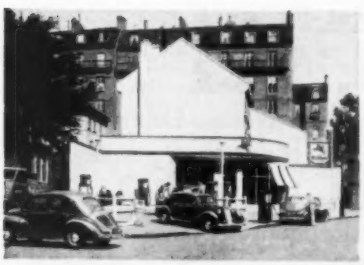
PARIS, FRANCE

BRUCK/MUR, STYRIA, AUSTRIA

SOCONY-VACUUM OIL COMPANY, INC.
and Affiliates
MAGNOLIA PETROLEUM COMPANY · GENERAL PETROLEUM CORPORATION

SOCONY-VACUUM

What is the Greatest of Executive Satisfactions?

It has been gratifying to see our business grow from humble beginnings to a worldwide organization with over 5000 employees.

It is pleasant to realize that we have met every challenge of an industry whose pace is fast and needs exacting . . . and agreeable to know that the service we perform has helped in a substantial way to conserve vital petroleum resources.

There is a thrill, too, in observing the results of consistent, long-range research — constantly improved processes, methods and equipment.

But the greatest satisfaction of all lies in the fact that, in our own way, we have provided a practical demonstration of the American system at work. By converting volume, experience, equipment and research into better service sold at less cost, we have expanded our market, provided employment for more and more people and in some degree reduced the cost of a basic commodity.

The cost of the average Halliburton cementing job is less today than it was in 1924.

Erle P. Halliburton

Chairman of the Company
HALLIBURTON OIL WELL CEMENTING CO.
Duncan, Oklahoma

What's NEW

In Perforating, Testing, and Fishing Tool Services

McCULLOUGH®
NEW SERVICES • NEW TOOLS
NEW WAYS OF DOING THINGS

Latest News About New Tools, Techniques and Services

LESS RIG TIME

with new McCullough Electric Wire Line Tools

JOBS SELECTED FROM RECENT McCULLOUGH FIELD REPORTS

*RIG TIME	McCULLOUGH TOOL	JOB ACCOMPLISHED
54 MINUTES	Glass Jet Perforator	72 holes shot at 4000 feet (greatest depth)
ONE HOUR 10 MINUTES	Magna-Tector	Located stuck point at 4500 feet
ONE HOUR 15 MINUTES	Jet Bottom Hole Cutter	Fragmentized junk at 1200 feet—two runs
ONE HOUR 45 MINUTES	String Shot	Backed-off tool joint at 6500 feet
ONE HOUR 55 MINUTES	Jet Back-Off Tool	Backed-off tool joint at 7000 feet
TWO HOURS 20 MINUTES	Type "B" Bridging Plug and running Feeler	Set plug at 6400 feet
THREE HOURS 45 MINUTES	Glass Jet Perforator	126 holes shot at 3600 feet (greatest depth)
FOUR HOURS 15 MINUTES	Radiation Well Logger (Gamma Ray)	Logging from 5600 feet to surface
FIVE HOURS	Burrless Bullet Perforator	270 holes shot at 8200 feet (greatest depth)
FIVE HOURS 10 MINUTES	Jet Casing Cutter and running Feeler	Casing cut at 13,000 feet
FIVE HOURS 45 MINUTES	Neutron Log	Logging from 4600 feet to 1000 feet
SIX HOURS 15 MINUTES	Combination Glass Jet and Burrless Bullet Perforators	306 holes shot at 8000 feet (greatest depth)
38 HOURS	Glass Jet Perforator	3700 holes shot at 10,000 feet (greatest depth)
73 HOURS	Burrless Bullet Perforator	7752 holes shot at 5000 feet (greatest depth)

*Includes setting-up at rig and tearing down equipment.

ACTUAL RIG TIME DEPENDS UPON WELL CONDITIONS.
The above jobs are not the fastest, nor are they average time. Well conditions vary to such an extent that the average rig time for any specific job or tool can not be determined accurately. Yet, many of these jobs were accomplished under severe conditions, and completed successfully in a few minutes or hours.

YOU CAN BE SURE McCULLOUGH WILL SAVE RIG TIME.
All McCullough electric wire line tools are electronically controlled at the surface, both visibly and audibly. This permits the tools to be run faster and to be positioned accurately. Thoroughly experienced servicemen, with years of practical oil field experience, assure you reliable, consistent results—in less time.

CALL YOUR McCULLOUGH SERVICE ENGINEER TODAY

PERFORATING, TESTING AND FISHING SERVICE ANYWHERE—ANYTIME!

McCULLOUGH TOOL COMPANY
5820 South Alameda Street, Los Angeles 58, California
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EXPORT OFFICE: Los Angeles, California

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SERVICE LOCATIONS: TEXAS: Houston, Snyder, Alice, Cisco, Corpus Christi, McAllen, Odessa, Tyler, San Angelo, Victoria, Wichita Falls, Luling, Beaumont, Sherman, Hadacol. **OKLAHOMA:** Oklahoma City, Guymon, Healdton. **MISSISSIPPI:** Laurel. **NEW MEXICO:** Hobbs. **KANSAS:** Great Bend. **WYOMING:** Casper. **CALIFORNIA:** Los Angeles, Avenal, Bakersfield, Ventura. **LOUISIANA:** Houma, Lake Charles, New Iberia, Shreveport. **COLORADO:** Sterling. **NORTH DAKOTA:** Williston. **UTAH:** Vernal.

Bethlehem 600...the pump with the fluid end for extra-high pressures

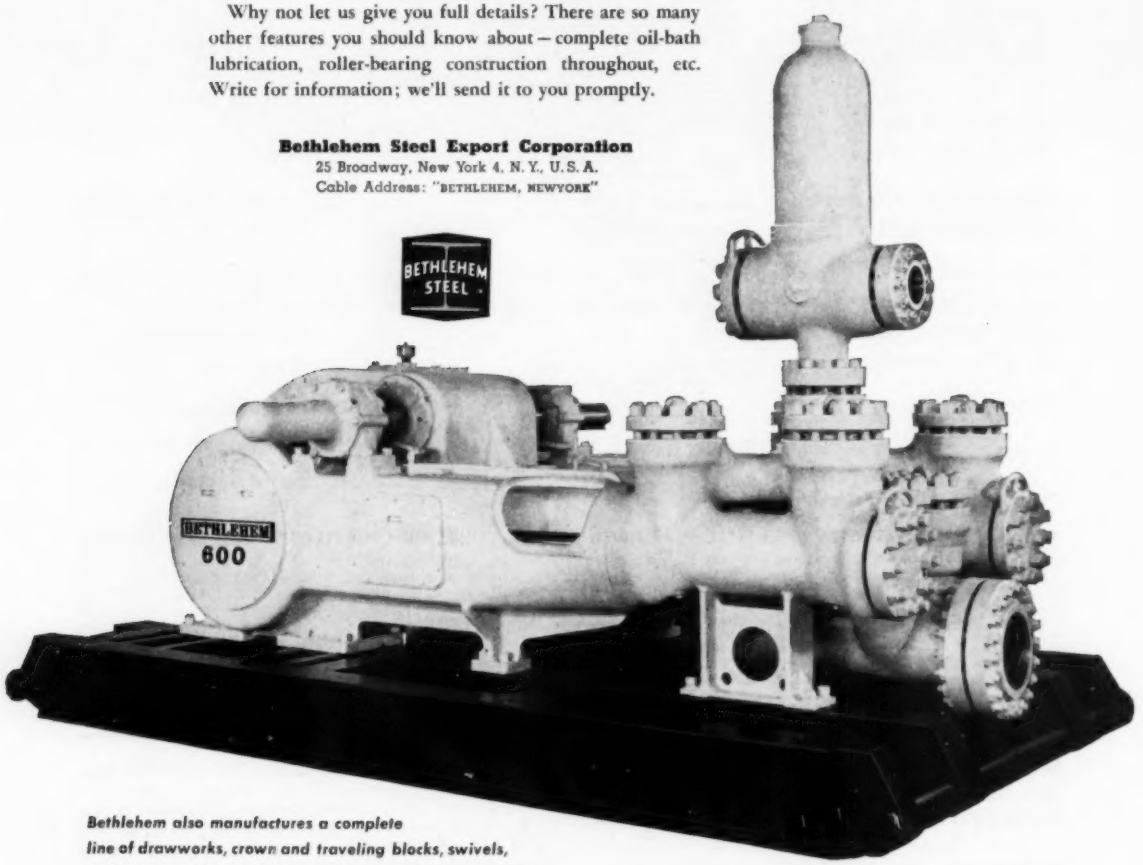
That old reliable of deep-well slush pumps, Bethlehem's 600, is now equipped with a new, superstrong fluid end to handle the pressure extremes so common in modern drilling. The new parts are thicker, more massive; you can appreciate their great strength merely by looking at them.

Even a brief study of this pump will show readily why it withstands high pressures with absolute safety. Just as a starter, consider the gaskets. They're A.P.I. metal-ring type on valve covers, suction and discharge flanges, and stuffing boxes.

But that isn't all. Cylinder walls are heavier. Valve covers too. And the air chamber. Every last part is designed and built for highest pressures.

Why not let us give you full details? There are so many other features you should know about — complete oil-bath lubrication, roller-bearing construction throughout, etc. Write for information; we'll send it to you promptly.

Bethlehem Steel Export Corporation
25 Broadway, New York 4, N.Y., U.S.A.
Cable Address: "BETHLEHEM, NEWYORK"



Bethlehem also manufactures a complete line of drawworks, crown and traveling blocks, swivels, and rotary tables; and, for production work, pumping units in a wide range of sizes and types.

"Considering the responsibilities now visible on our industry's horizons, we realize oilmen must continue to play an extremely important part in the constructive development of our world. The future is calling for leadership inspired by the kind of democratic principles which have shaped the oil industry. As an oilman, I am proud of our past record and look forward eagerly to the opportunity of even greater service to the world."

From a speech by Eugene Holman, President, Standard Oil Company (New Jersey)

STANDARD OIL COMPANY (NEW JERSEY)

AND AFFILIATED COMPANIES

ONLY 4-WHEEL-DRIVE

...Goes Everywhere in the Oil Field!

Oil men judge a vehicle by its ability to take them wherever they have to go. Experience has taught them that nothing less than 4-wheel drive gives them the kind of transportation they need. That is why the 4-Wheel-Drive Willys Station Wagon is so widely used to carry personnel, supplies and equipment *everywhere* in the oil field. We will gladly send you complete information about this vehicle, and the name of the nearest Willys-Overland dealer, upon request.

PROSPECTING is easier when exploration parties use the 4-Wheel-Drive Willys Station Wagon to reach places where other vehicles cannot go.

DRILLING delays are reduced to a minimum when this car keeps crews supplied with the tools and equipment needed for any emergency.

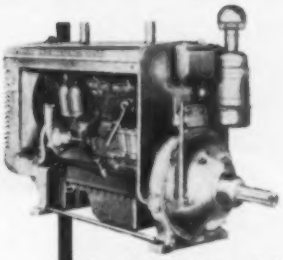
PIPING is another oil field activity speeded by this "go-anywhere" vehicle as it shuttles back and forth with inspectors, maintenance men and replacement parts for heavy machinery.

4 Wheel-Drive WILLYS STATION WAGON

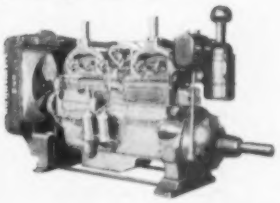
WILLYS-OVERLAND EXPORT CORPORATION
Toledo 1, Ohio, U. S. A.

6 Diesel Power Units

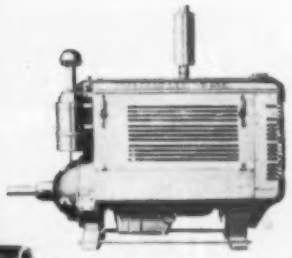
Each one backed by REPUTATION that has carried the International name throughout the world . . . ECONOMY proved by thousands of units giving dependable, low-cost performance . . . maintenance available from the SERVICE FACILITIES of your International Industrial Power Distributor.



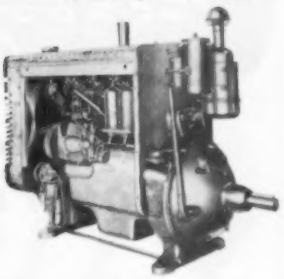
UD-18A, 125 h.p. at 1,600 r.p.m. 6-cylinder Diesel



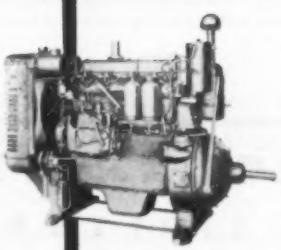
UD-16, 100 h.p. at 1,800 r.p.m. 6-cylinder Diesel



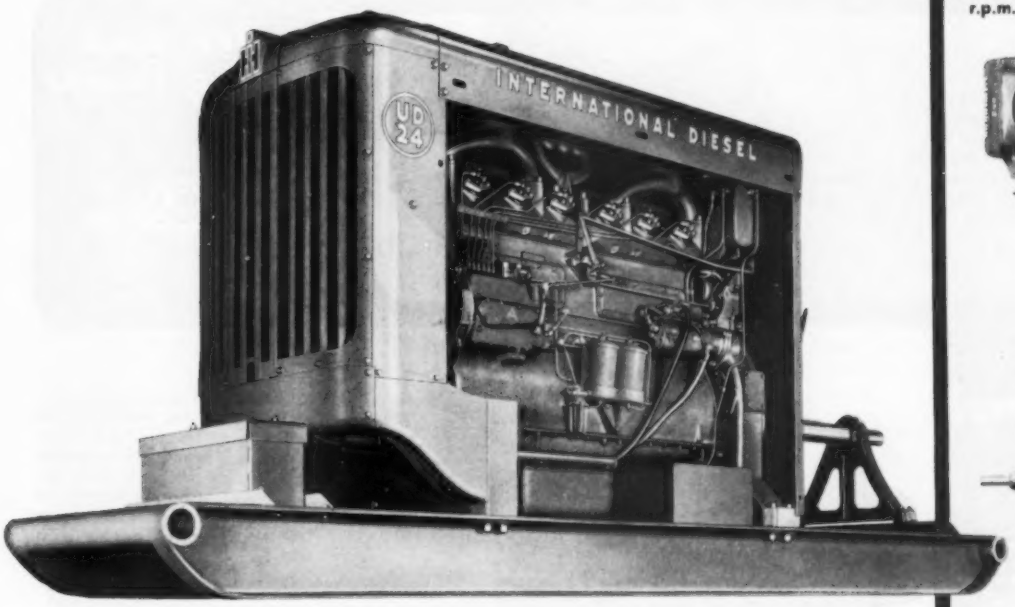
UD-14A, 76 h.p. at 1,400 r.p.m. 4-cylinder Diesel



UD-9A, 62.5 h.p. at 1,500 r.p.m. 4-cylinder Diesel



UD-6A, 45 h.p. at 1,600 r.p.m. 4-cylinder Diesel



UD-24, 180 h.p. at 1,375 r.p.m. 6-cylinder Diesel

The tremendous advantages offered by International Harvester are found on all the six continents. They are important factors in supplying world-wide industry with International Power Units and Tractors.

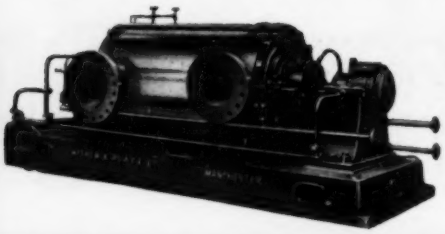
To you, the International Industrial Power Distributor represents these advantages. He specializes in application and service of this equipment . . . can give you expert guidance in selection of the right power unit for *your* particular requirements.

What's doubly important, he offers engineered replacement parts, trained personnel and sound service procedures to keep your equipment at original performance. See him now. International Harvester Export Company, 180 N. Michigan Ave., Chicago 1, U.S.A.

INTERNATIONAL INDUSTRIAL POWER

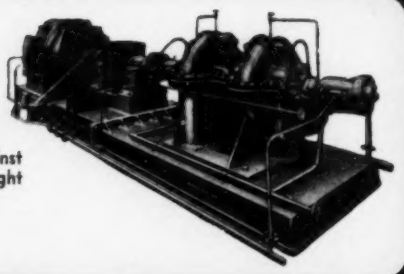
Centrifugal Pumps
& FLAMEPROOF MOTORS

Main Pipeline Pumps....



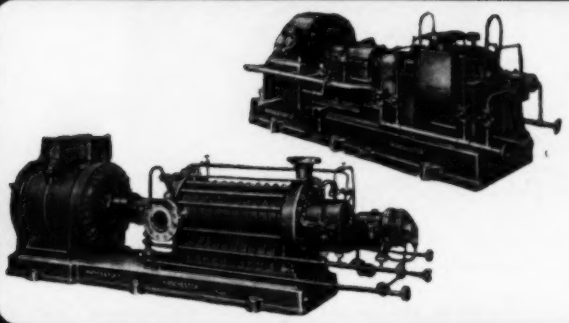
Mather & Platt multi-stage 'Plurovane' pumps were amongst the earliest centrifugal pumps installed for main line work. The pump shown on the left is a typical modern 'Plurovane' designed for a throughput of 50,000 bbls/day of crude oil against a pressure of 750 p.s.i. when running at 1500 r.p.m.

Transfer and Loading Pumps



Our standard ranges include a pump for nearly every transfer or loading duty. The two-stage "Medivane" pump illustrated on the right can handle 700 tons/hr. of crude or products against heads up to 500 ft. It is driven through a gas tight wallbox by a 550 h.p. Mather & Platt Motor.

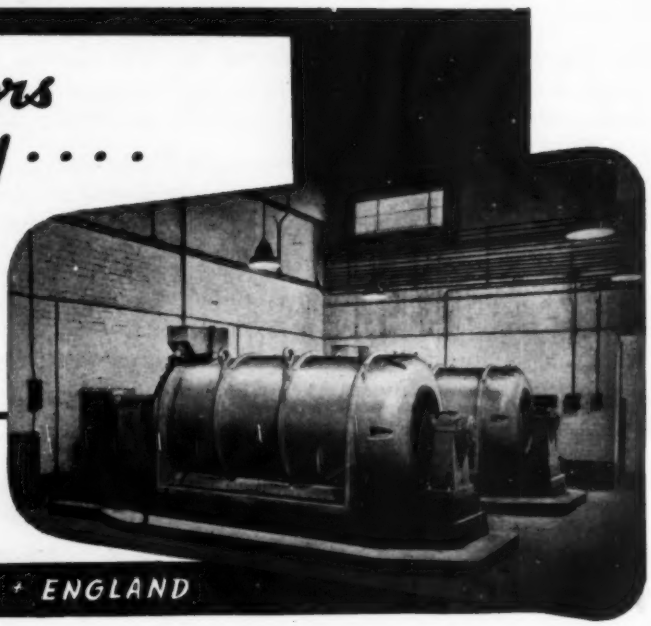
Refinery Process Pumps



Our long refinery experience at home and abroad enables us to supply pumps for the most arduous refinery duties. The illustration shows typical units:—a steam turbine driven pump handling oil at 500 degs. F. and a motor driven "Plurovane" pump dealing with light volatile hydrocarbons.

Flameproof Motors on Pipeline Duty....

Mather & Platt electrically-driven centrifugal pumps on an oil pipe line. The motors here illustrated are of the totally enclosed flameproof type, and are of 1,000 h.p. capacity, fed from a 3 phase 50 cycle 6000/6600 volt supply. They are squirrel cage direct-on started machines with a starting current of four times full load value.



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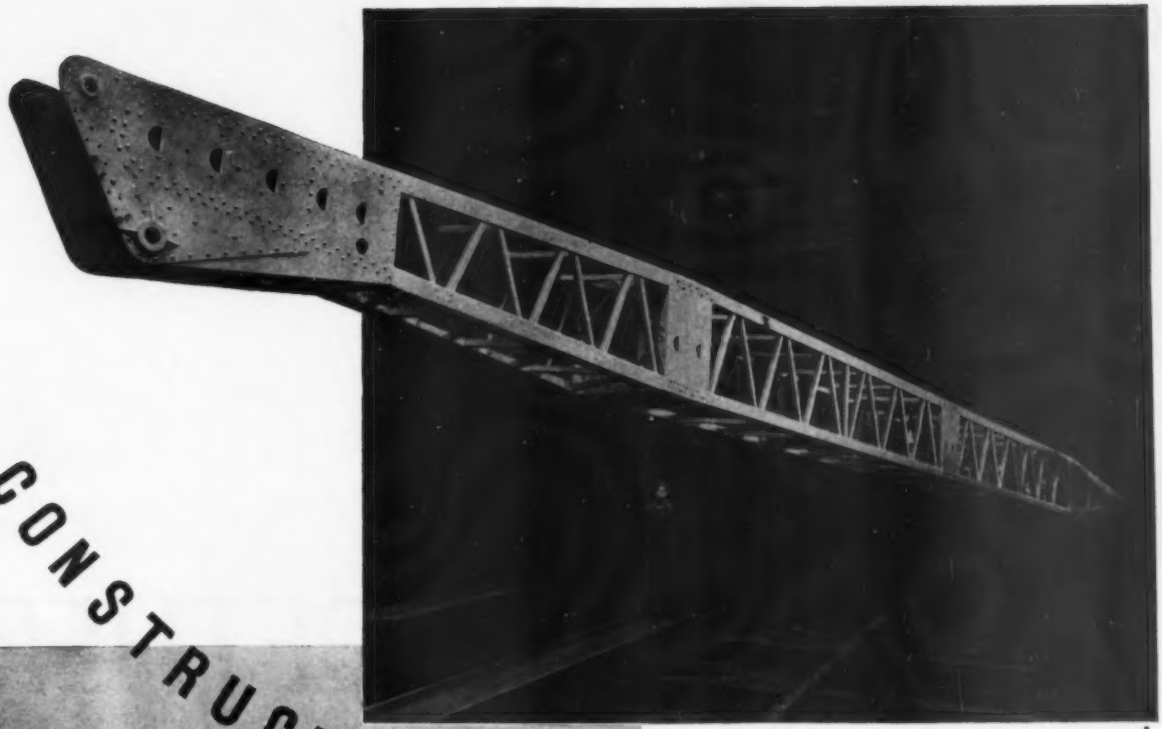

150ft. Mild Steel Riveted Derrick Mast photographed in the Butterley Constructional Department.

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CS. 34

WORKING TOGETHER

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Private industry has created jobs in Saudi Arabia for the 13,786 Saudi Arabs and 3,230 Americans employed by Aramco.

31 new oil wells were completed during the year and two new oil fields were discovered.

55,311,846 barrels of refined products were produced at the Ras Tanura refinery.

Aramco is owned by four American oil companies whose stockholders number more than 600,000 individuals.

Arabian American Oil Company

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** The operational figures are from the 1951 Annual Report of Operations to the Saudi Arab Government.*

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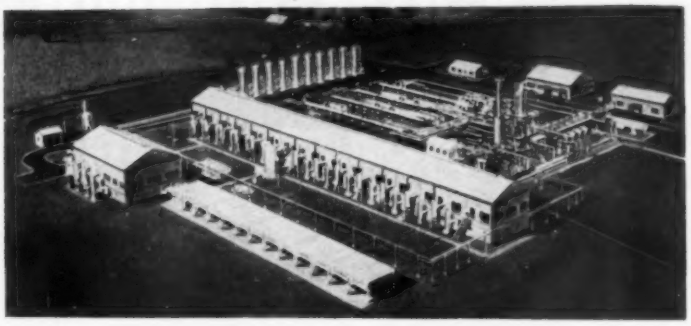

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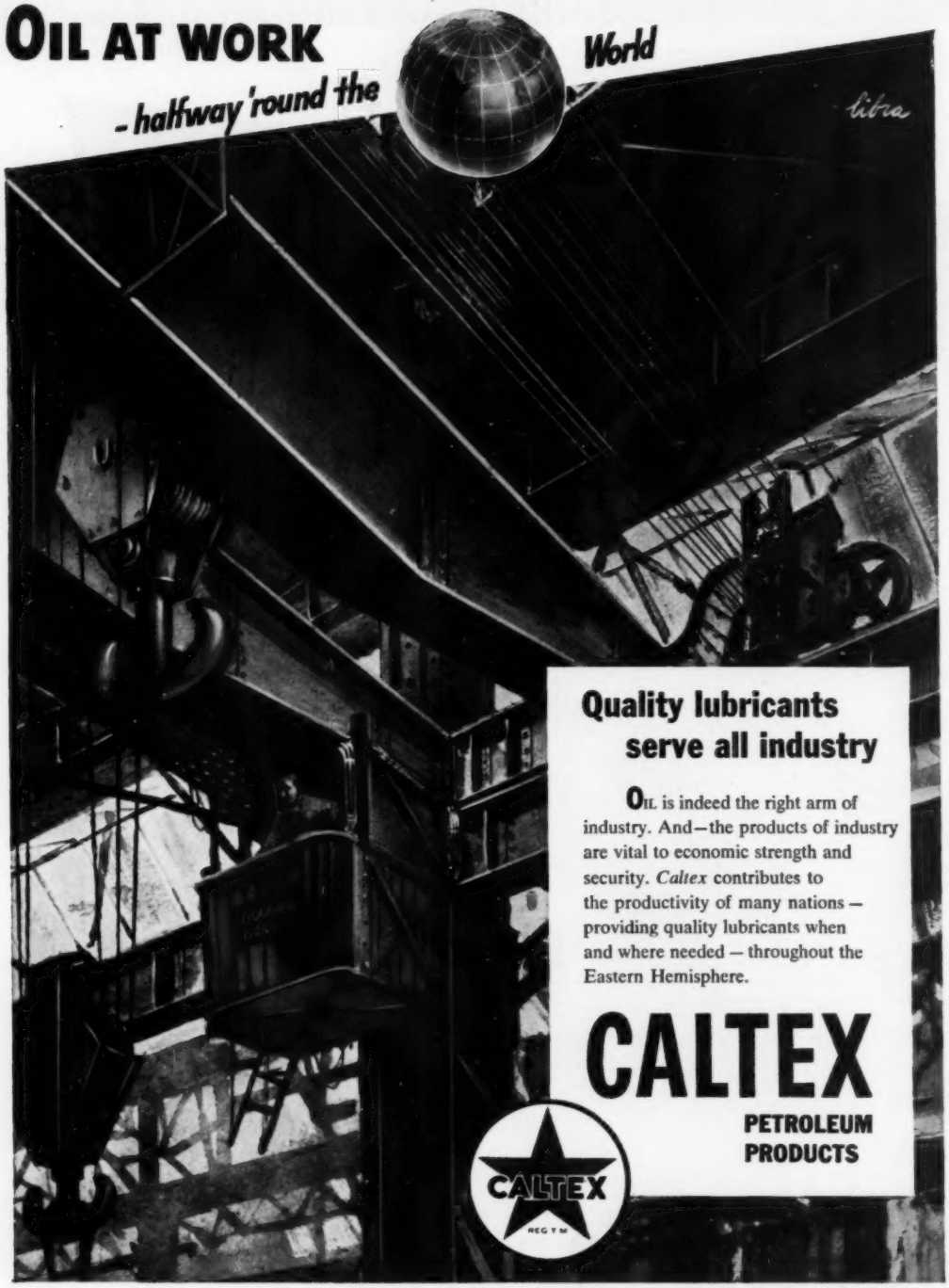

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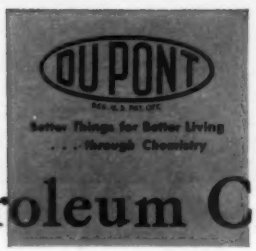

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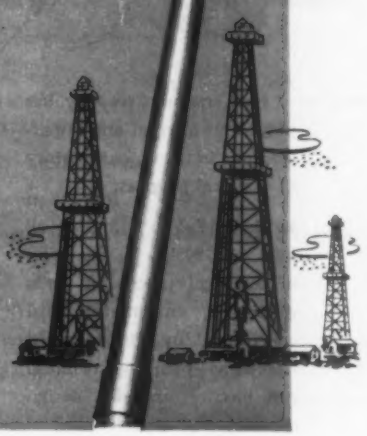

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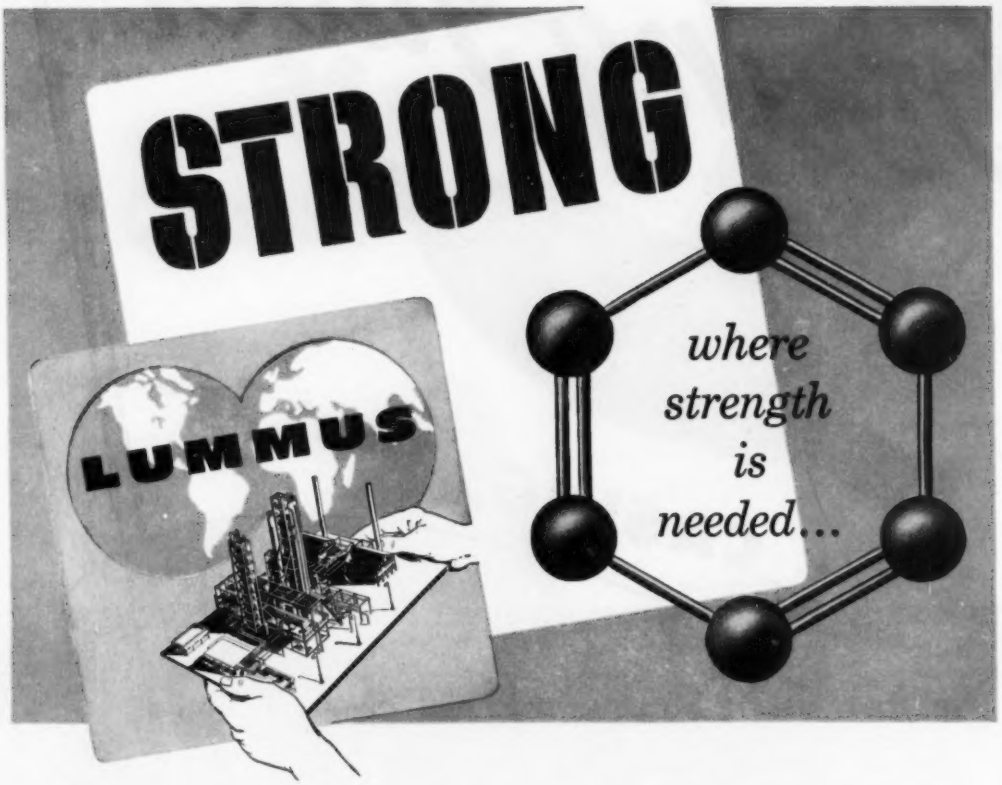

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VOL. 23 NO. 7
JULY 1952

World Petroleum

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

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THIS MONTH'S COVER

Typical of the terrain of the Uinta Basin is this photograph of surveying operations in the Rocky Mountain region, which is reproduced through the courtesy of the Standard Oil Co. (N. J.). Please turn to page 28 for a detailed study of operations in the Uinta Basin region.

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BYWORD IN THE BAYOUS

In swampy forests and marshland waterways, on glittering lakes and coastal canals, you'll frequently see Halliburton's silver and red cementing barges moored to drilling rigs. These barges are converted LCT's and the sight of them in semi-jungle settings may be reminiscent of their recent South Pacific service. But they're not landing tanks this time, they're supplying complete cementing services to the oil industry. Halliburton launched its Marine Department seven years ago and now has five cementing barges regularly plying the water-logged locations where oil wells are drilled. Each barge is completely equipped for cementing all types of wells and carries its own bulk cementing facilities. Successfully sailing through many marine jobs has made Halliburton the byword for service in the bayous.

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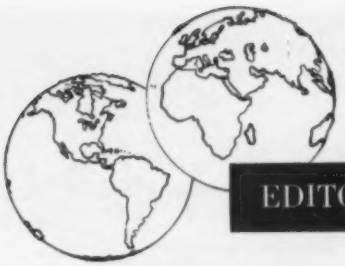


EDITORIAL

HOPE FOR A RETURN TO FREEDOM

BEYOND QUESTION, the decision handed down on June 4 by the Supreme Court of the United States negating the action of President Truman in seizing the country's steel mills will rank as its most important action of recent years. Possibly, though not certainly, it may work a change in the trend that has ruled the course of the nation over the main portion of a generation and consequently may powerfully affect its future destiny.

Whether or not this is to be the result is for the future to decide. The significant point that stands out now and that gives heart to those who still have faith in the traditional system that has made America great, is the fact that for the first time in a score of years the supreme authority of the nation has called a halt to the movement toward the centralization of power in the executive branch of the federal government.

The change that has taken place has been at once so gradual and so insistent that its full effect can be appreciated only by a survey of the whole period during which it has been actively at work. It has brought about the creation of a vast bureaucracy built up in part with sanction of the law making branch of the government, and in part through the unauthorized usurpation of authority, with the result that over two and a half million persons or more than one in fifty of the adult population are directly employed by the executive branch of the national government. Agency has been added to agency, bureau piled upon bureau, nearly all engaged in regulating the activities which citizens once were permitted to manage for themselves. The insidious belief that individuals must depend upon government for security and support instead of relying upon their own efforts has been inculcated in a hundred different ways. A vast structure of taxation has been laid upon the shoulders of the populace and has been built to almost intolerable dimensions, these very funds being used to increase their dependence upon the centralized machine that is theoretically their servant. Through license to particular groups and classes including political favors and the outright bestowal of gifts and subsidies, support has been gained for the actual betrayal of the body politic by those appointed to guard its interests.

The transformation that has taken place within the span of less than an average lifetime has been succinctly portrayed in a brief personal narrative by Dr. Mario Pei, professor of Romance Philology at Columbia University, published in a recent issue of Saturday Evening Post. Dr. Pei refers to his arrival in the United States from Italy 44 years ago and paints the contrast between the two countries which most impressed him at the time. As he points out, Italy, like America, was a "democracy," but it was held in the tentacles of a huge bureaucracy. The government directed every movement of its citizens at every turn. Taxes were imposed on the simplest commercial transactions. No business could be started or operated without the approval of a hundred bureaucrats. As a result, young people, instead of going into business for themselves, thought only of finding a safe haven in some government job, no matter how pitiful its reward.

Upon his arrival in America, he was impressed and amazed by the complete freedom that prevailed. He marveled at the fact that business agreements and contracts could be made without government intervention, that it was possible to travel from one end of the country to the other without encountering a customs house or a tax collector, that the national ideal was not the security of some obscure official post, but the boundless opportunities of a free economy, that no honest citizen feared his government or faced the necessity of submitting his personal affairs to its prying inquisition.

Somewhat sadly he records the disillusion of these earlier recruits from overseas as they have watched the growth in their adopted country of the familiar European style of government octopus, along with the disappearance of the American spirit of freedom and opportunity for "security" in a world where not even life itself is secure.

The fact that a single blow has been struck against this destructive menace does not mean that a revolution in thought and policy is at hand. It does give hope that the spirit which inspired America during its rise to greatness may reassert itself and that it may avoid the fate of becoming a miasmatic waste of hopeless subservience and the battening ground of the predatory few.

A light snow outlines the stark canyon-scarred wasteland of the rugged Willow Creek Canyon area south of Ouray, Utah. This is typical of many of the remote Uinta Basin areas where companies are searching for oil. All photographs with this article are reproduced through the courtesy of The Carter Oil Co.

Carter Oil Company's No. 1 Rosemary Lloyd, Roosevelt Pool step-out, was temporarily abandoned in mid-April at 11,888 feet.

OIL EXPLORATION

By Maury Goodin* and

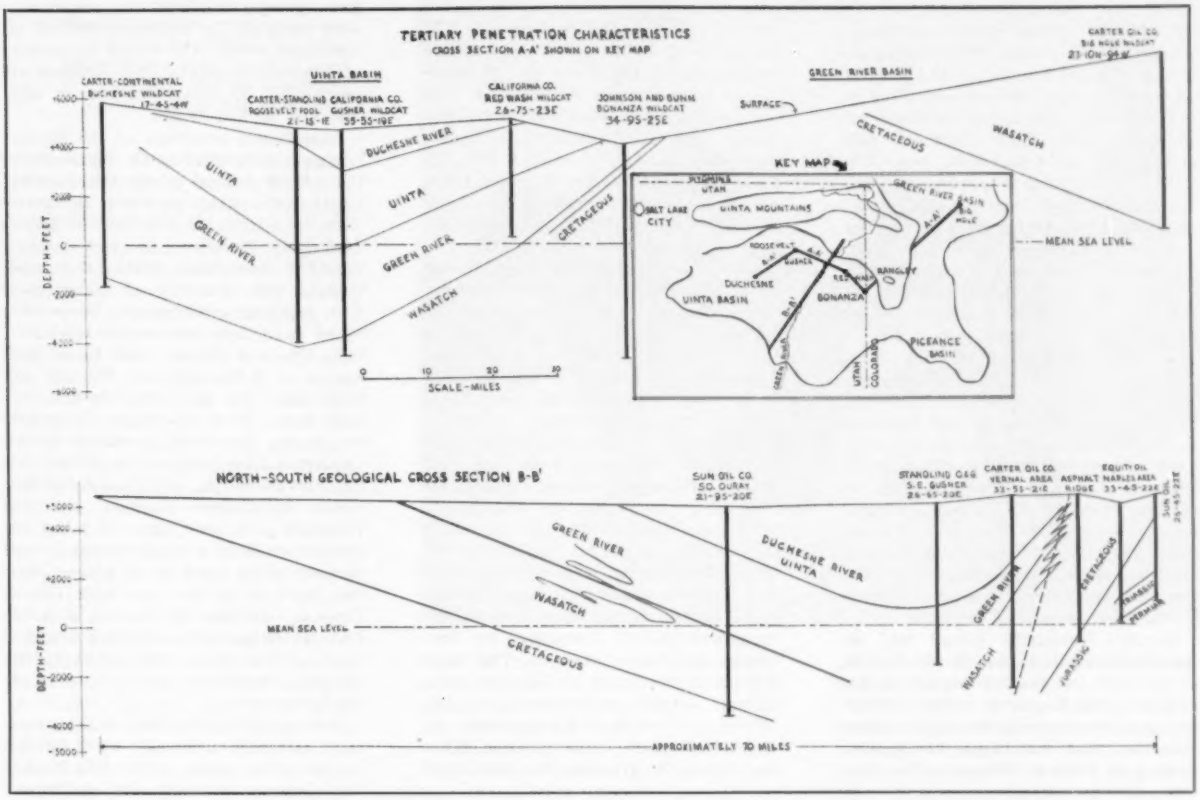
MORE THAN fifteen million dollars has been spent in the past five years in the search for oil in the Tertiary area of the Uinta basin in northeastern Utah. Three important oil fields have been discovered and another discovery is presently noncommercial. However, exploration is continuing at an ever-increasing pace, indicating the importance placed on this large basin area by oil operators of the nation. More than five million acres of lands are presently leased.

This basin is one of the most important, from an oil exploration standpoint, in the nation. The discovery of oil in this area focused attention on one of the largest sedimentary basins in the Rocky Mountains, where there had been little previous deep drilling. As of Jan. 1, 1952, there was a drilling density of one dry hole for each 900 square miles of Tertiary area in the basin. At that time there was one discovery for each 3.25 dry holes, an extremely high average for such a rank wildcat area as this was considered to be only three years ago.

The fact that production was established in the Tertiary was also of importance, as Tertiary beds had not been productive of large oil reserves in the Mountain states previously. Gas is produced from a few fields along the Colorado-Wyoming state line and in the San Juan basin from Tertiary sands, but there had been no sizeable Tertiary oil production in the eleven state region prior to the discovery at Roosevelt. As a result of recent discoveries in the Uinta basin, increased attention is being paid to Tertiary possibilities throughout the Rocky Mountain region.

The Uinta basin covers approximately

* Co-Owner, Petroleum Information, Denver-Casper



IN THE UINTA BASIN

E. A. Polumbus, Jr.**

fifteen million acres in northeastern Utah and northwestern Colorado. Oil was discovered in the basin as early as 1902 when early production was established from shallow Mancos shale wells in the Rangely field, Moffat County, Colorado. There were subsequent discoveries at Thornburg, in 1925, Tow Creek, White River, Moffat, Maudlin Gulch and Iles Dome, each on well-known surface structures and with the majority of production from the lower Cretaceous beds. In 1933 oil was discovered in the Weber (Pennsylvanian) at Rangely and production from this field, 60,000 barrels of oil daily, represents the largest single producing field in the Rocky Mountains.

The Tertiary producing area of the Uinta basin lies west of Rangely and other fields producing from Cretaceous and lower beds, and it is this area which during the past five years has been of increasing interest. The present exploration program was started in this basin in 1945 when Carter Oil Co. and others started acquiring sizeable blocks of fee lands through the area and did detailed seismic work through portions of the basin. Carter subsequently started a drilling program on the Vernal unit, covering some 55,000 acres along the northeastern part of the basin. Carter drilled four consecutive, expensive dry holes on this block and found shows of gas and oil in three of the wells. However, following extensive testing, the wells were plugged as non-commercial. Carter is now drilling a sixth wildcat on this block.

Carter joined with Stanolind Oil and Gas Co. in drilling a fifth well, the Roosevelt field discovery southwest of the Vernal block. This pool is the largest yet found in the Tertiary portion of this

** Consulting Petroleum Engineer, Denver

Night scene during rigging up operations on Carter Oil Company's No. 2 Duchesne-Ute Tribal.

basin. Well No. 1 Ute Tribal, C NW SW 21-1S-1E (Uinta Special Meridian), was completed in June, 1949, flowing an initial of 1,633 barrels of 32.6 gravity oil daily through open tubing. Production was from the fractured shales of the basal Green River (Tertiary) formation between 9,351 - 9,392 feet. The well has continued to produce through choke at 400 to 600 barrels of oil daily, with an accumulated production of more than 500,000 barrels since that time. The well is now producing on Kobe pump.

Discovery at Roosevelt followed detailed seismic work in this area and apparently the structure follows a general northwest-southeast trending high through this area. The basal Green River formation was found at 5,765 feet in the discovery and the well was still in that formation at total depth, some 3,600 feet of section. The Green River formation is almost entirely oil shale, of the type found on the surface and being mined for oil in the Rifle area of Colorado. The highly fractured zones of this shale are the sections where oil production may be expected in a large portion of the Tertiary area of the basin.

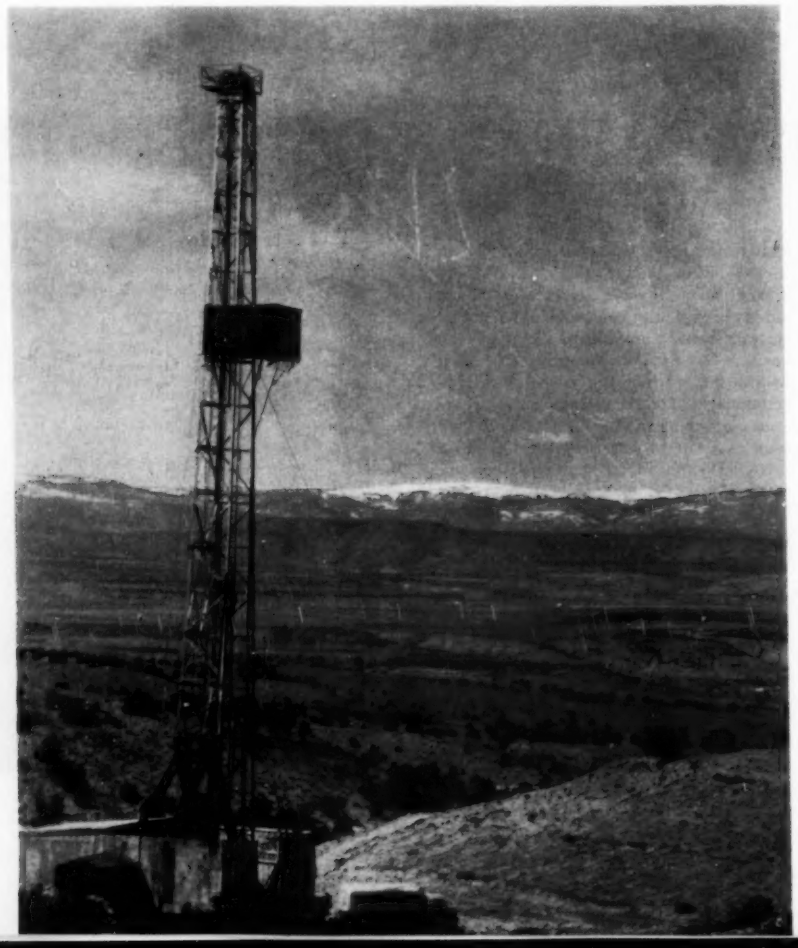
Carter - Stanolind's second well at Roosevelt had an initial of 439 barrels of oil daily, less than the discovery due to less highly fractured section. Carter unitized this area with holdings of other operators, and has based development drilling on units of 360 acres. The company is currently drilling below 11,500 feet at No. 1 Rosemary Lloyd, C NW SW 24-1S-1E (USM), two and one-half miles east of the discovery. Another Carter well, near the discovery, is near completion. Three miles west of the discovery Phillips Petroleum Co. is installing pump on No. 1 Leeton, C NE NE 24-1S-1W (USM), after that well made oil on tests of the basal Green River zone. Gulf Oil Corporation's No. 1 Whitlock, C SE SW 10-1S-1E (USM), two miles northeast of the discovery, flowed an estimated 20 barrels of oil per hour through choke from the same general fractured shale zone with total depth at 9,276 feet. Carter and others are continuing the development drilling program in this field, which will apparently be a major oil field for this area.

An unusual feature of the oil found at Roosevelt is the high pour point, and this factor causes considerable producing difficulties. Pour point of this oil is 90° F., and that of other crudes found in the basin has been as high as 100° F. This oil contains 40 percent paraffin. The problems encountered handling this crude on the surface have been solved by providing heat throughout the flow system and tank batteries. The most difficult problem thus far has been combatting paraffin accumulation in the tubing, particularly in flowing wells. At Roosevelt, paraffin was removed from the tubing by frequent scraping until Kobe pumps, utilizing hot power oil, were installed. At Duchesne, hot oil is circulated around the tubing by means of a special casing string. Initially a similar hot oil circulating system was installed at Red Wash.

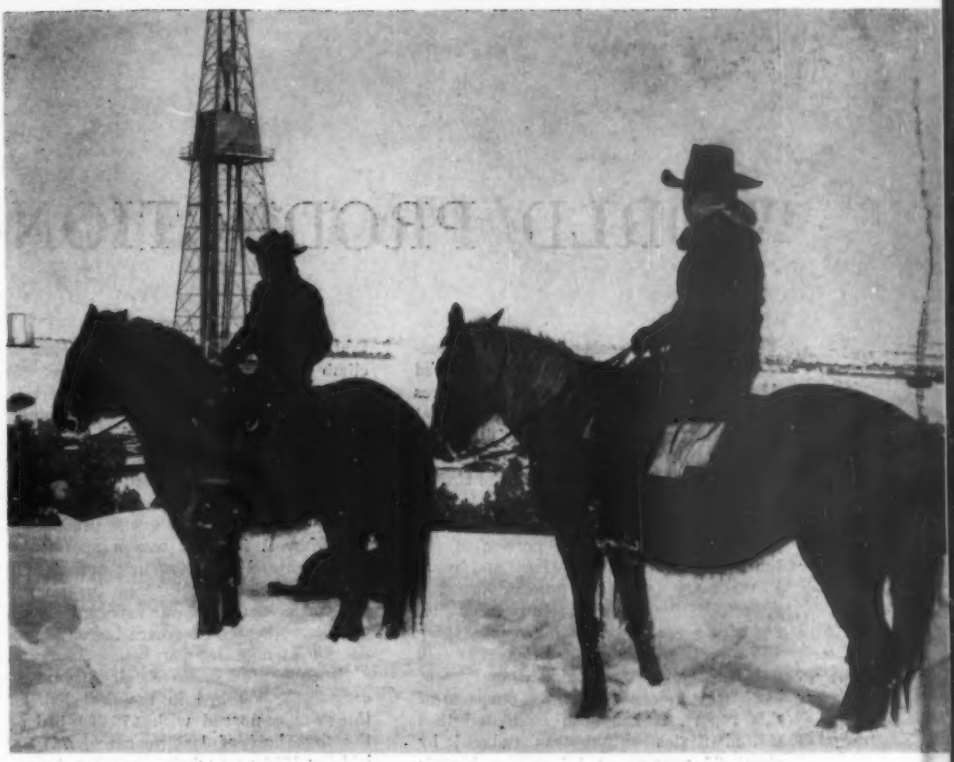
Immediately southeast of the Roosevelt pool, the California Co. found oil in the second wildcat along the general southeast-northwest trend. However, Well No. 1 Unit, SE NW NW 35-5S-19E (Salt Lake Meridian), at Gusher, went to 9,757 feet total depth, and was plugged back to 8,950 feet for completion, pumping approximately 35 barrels of oil daily from the zone, 8,699-8,950 feet. The well topped Green River formation at 5,454 feet and Wasatch at 9,157 feet. The well failed to find the basal Green River zone highly fractured as in the Roosevelt producing wells. California later plugged No. 2 Unit, C SE SW 21-5S-19E (SLM), located between the Gusher discovery and the Roosevelt pool, after the well failed to show more than a small amount of oil on tests of the basal Green River. This well went to 10,500 feet with Green River at 5,636 feet and Wasatch at 9,348 feet. There has been no further development on this block, although Stanolind recently completed a dry hole south of the Gusher area.

Wells drilled in the basin at this point were extremely costly, generally following extensive seismic work. The Roosevelt discovery reportedly cost on the order of $500,000. All of the wildcats and a majority of the development wells had extensive coring and testing. However, Carter's faith in the area over a four year period had definitely proved well founded, and the company was beginning to find answers to some major questions.

The well that made the Tertiary portion of this basin of greatly increased interest to smaller operators and independents was the California Company's discovery at Red Wash, 25 miles west of the Rangely field in Colorado but still in the Utah Tertiary area of the basin. Well No. 1 Unit, NE NE NE 26-7S-23E (SLM), was completed at the rate of 392 barrels of oil daily through three-eighths inch choke. Production in this field is from sand lenses in the Green River formation at depths varying from 5,100 to 5,700 feet. The discovery flowed gas at the rate of eight million cubic feet daily from the zone 4,345 to 4,375 feet, and was completed from oil sand lenses in the zone 5,160 to 5,270 feet. There are now 13 completed oil wells in the field, with California drilling two additional wells. The second well in the field is a shut-in gas well. The sand zones vary in thickness from ten to one hundred feet. The oil from these wells is lower in gravity than that at Roosevelt, at an



Drilling rig on The Carter Oil Company-Continental No. 1 Duchesne-Ute Tribal discovery well.



Robert Colorow and his son Marshall, members of the Ute Tribe near Duchesne, Utah, rest their ponies after a ride from their home to visit Carter Oil Company's No. 2 Duchesne-Ute Tribal well.

average of 29° API and 95° F pour point.

With completion of the Red Wash discovery in February 1951, California started on an immediate drilling program and has continued the program for the past year. There are presently 1,800 acres proven in the field with an 80-acre spacing program established.

In July 1951 Carter Oil joined with Continental Oil Company in making a new discovery, southwest of previous Tertiary production, at the Duchesne wildcat. Well No. 1 Ute Tribal, C SE NE 17-4S-4W (USM), was completed with an initial of 538 barrels of 42 API gravity oil daily through one inch choke from the fractured basal Green River zone between 7,486-7,596 feet total depth. Pour point of this oil is 100°F. However, production dropped fairly rapidly in the initial stages of testing so that the well is currently making approximately 150 barrels of oil daily. Again, the producing zone is from fractured shale, with the general block along a line of east-west faulting. Carter, as operator, started No. 2 Ute Tribal, C SE NW 16-4S-W (USM), and this well has had a number of shows to depths below 10,500 feet. However, tests have not indicated other producers as large as the discovery well. Carter also started No. 1 Willis Moon, C SE SE 13-4S-4W (USM), a wildcat three miles east of the Duchesne discovery and along the same line of faulting. The latter well will be of interest in estimating the extent of possible production in the area.

In an area where three years ago there was one rig running, the activity has increased enormously during the past three months. There are now 21 rotary rigs drilling on wells in the basin, with all but three of these on wildcat or important extension locations. New wildcat drilling has extended southward in the basin, with several of the wells testing zones in the upper Cretaceous. Recently Carter recovered a small amount of oil on tests in the Mesa Verde, a zone not previously productive in this portion of the basin. However, the well was abandoned after the zone proved non-commercial. Future drilling is expected through the Cretaceous, however, particularly in the southern portion of the Tertiary area, where Tertiary zones do not reach the thickness found in the Roosevelt-Gusher areas.

A possible new discovery is still being tested in this southern portion, the Deep Well Production Co. No. 1 Lambert, C SW SW 22-8S-16E (SLM), in the South Myton area, southern Duchesne County. This well encountered fractured basal Green River zone between 6,265-6,314 feet and made an estimated 100,000 cubic feet of gas daily from that zone with 590 feet of 44-gravity, 82-pour-point oil recovered in one hour. The operator cemented casing and is testing the well from that zone.

Although Carter, Continental, California and Stanolind have led in oil exploration through the Tertiary area of the Uinta basin, a large number of operators have acquired leases in the basin as a result of these discoveries. Sinclair Oil & Gas Co., Gulf Oil Corp., The Texas Co., Sun Oil Co., General Petroleum Corp., Cities Service Oil Co. and others have extensive lease holdings. A number of individuals acquired acreage spreads through the area during the early leasing period, although present expensive drilling has precluded their wildcat drilling to the present time. Acreage costs have jumped considerably, partially as a result of the discovery of oil at a more shallow depth at Red Wash. Prices reportedly of $25 per acre are not unusual, indicating acreage acquisition costs higher than those normally maintained throughout the Rocky Mountains. Nevertheless, a large part of the acreage within the active areas has been acquired by major and large independent operators.

That the exploratory drilling program will continue at a rapid pace through this basin is assured for the next several years by several factors. The acreage holdings of a number of operators are so large that a number of farm-out deals are now in the process of completion. Union Oil Co. of Calif., Sun Oil Co., Sinclair and others are expected to start immediate wildcat drilling programs. Phillips and Gulf are now completing producers at Roosevelt and are expected to expand their drilling program with wildcat activity on present lease holdings. The California Co. is in the process of unitizing sizeable lease blocks for drilling wildcat wells.

Seismic work is expected to increase in this basin during the coming year, although all geophysical work suffered from an extremely severe winter this year. During 1951 there were 385 crew weeks of gravity and seismic work done in Utah, more than 75 crew weeks over that done in 1950. All but a small part of this was in the Uinta basin. California, Carter, Cities Service, Continental, General Petroleum, Gulf, Ohio, Shell, Stanolind, Sun and Superior did geophysical work in the basin during 1951.

Indicative of the importance of the basin for operations are the large budget plans for the area by several major operators. Carter, California and others have announced considerably increased budget plans, with more than ten million dollars to be spent in the area during 1952. The oil is presently being moved by trucks from Roosevelt, Red Wash and Duchesne fields, but consideration is reportedly being given to additional pipe line facilities, with the possibility of construction of paraffin plants in the field for processing of the crude prior to shipment. The Salt Lake Pipe Line Co. (Standard of California) refinery at Salt Lake City has been expanded, and the company recently announced that its products pipe line from Salt Lake City to Pasco, Washington, will be looped at a cost of eight million dollars.

So, although a number of questions remain to be answered on the accumulation and production of oil from the Tertiary zones of the Uinta basin, every technological aid being used by the nation's oil industry is now available in working out these answers. The result undoubtedly will be the establishment of sizeable oil reserves in this large region.

WORLD PRODUCTION STAYS CLOSE T

ESTIMATED world crude oil production in the first half of 1952 averaged 11,866,400 barrels daily. This compares with 11,695,700 barrels daily in the first half of last year, an increase of less than two percent.

Estimates of crude output in the United States are highly tentative as this is written, because of the recent strike which shut down a large portion of the industry's refinery operations and made it necessary to reduce production. The American Petroleum Institute has not issued its usual weekly figures for May and the true volume of production will not be known until official government figures are released. For the purposes of this report, it has been calculated that United States output was reduced by about 26 percent or 1.7 million barrels daily in May to 4,700,000 b/d. First quarter output in the United States averaged 6,323,000 b/d and second quarter production was down to perhaps 5,686,000 b/d.

Outside of the United States, world crude production increased 217,500 b/d in the first half of the year as compared with the first six months of 1951. Increase in this area was 3.9 percent, to 5,862,400 b/d. The United States produced 50.5 percent of the world's supply of oil compared with 52 percent a year ago.

Eastern hemisphere crude production has continued its steady rise thus far this year. In the Middle East the loss of Iranian oil in the world market has been completely made up by increases in Iraq, Kuwait, and Saudi Arabia.

Iraq has contributed largely to the new oil supply in recent months. Beginning the first of the year, the Zubair field operated by Basrah Petroleum Co., Ltd., in southeastern Iraq began sending oil to market for the first time. January production averaged 14,300 b/d. This was doubled in February and by March was up to 45,000 b/d.

In April the new Iraq Petroleum Co. 30-32 inch pipe line began delivering Kirkuk crude to Banias on the Mediterranean coast. The line has an initial capacity of about 300,000 b/d and will permit withdrawals from the Kirkuk field to be nearly doubled. In 1951 Kirkuk production averaged 166,000 b/d, which was approximately the capacity of the two previously laid 12-inch pipe lines from Kirkuk to Tripoli.

It required some two million barrels of oil to fill the new line. This operation was begun in the first quarter so that Kirkuk production actually began to climb in February. January output was 167,000 b/d, February 188,000 barrels, and March 212,000 barrels. Full impact of the line opening will not be apparent until the second half of the year.

The two other principal producing countries in the Middle East maintained a steady upward pace in crude production. The Kuwait increase was a spectacular 68 percent. Production in Saudi Arabia rose 29 percent. Although the volume was much smaller, Qatar reported a comparable percentage increase in crude production of about 32 percent.

Crude production in Saudi Arabia averaged 858,900 b/d in the first half of the year compared with 673,900 b/d in the first half of last year and 761,500 b/d for 1951 as a whole. Arabian American Oil Co. has continued a moderate drilling campaign, completing 20 wells in the past six months. There are now 127 producing oil wells and three gas wells in the country. Of the eight proven fields, four are being produced and four are shut in at present.

Kuwait produced 18.3 million tons of crude in the first half of 1952 compared with 10.9 million tons in the same period a year ago. Daily average output in barrels was 750,000. Kuwait Oil Co. has largely completed its initial drilling program on a 600-acre spacing pattern in the Burgan field and now is filling in on a 300-acre basis. The company has drilled two additional wells in the vicinity of the Magwa discovery some seven miles north of Burgan. It is not yet known whether this discovery is a new field or an extension of Burgan.

American Independent Oil Co. and Pacific Western have not as yet announced a discovery in the neutral zone between Saudi Arabia and Kuwait. It has drilled five tests in the past year.

PERCENTAGE DISTRIBUTION OF PRODUCTION

	1939	1950	1951	1st Half 1952
Principal Nations				
United States	60.0	52.0	52.2	51.5
Venezuela	9.8	14.4	14.5	15.4
USSR	10.5	7.3	6.9	7.3
Iran	3.7	6.4	2.9	—
Saudi Arabia	0.2	5.3	6.5	7.3
Kuwait	—	3.3	5.0	6.7
Western Hemisphere	76.7	71.5	72.1	71.5
North America	63.2	54.6	55.1	53.7
South America	13.5	16.9	17.0	17.8
Eastern Hemisphere	23.3	28.5	27.9	28.5
Middle East	6.0	17.3	16.8	17.2
Oceania and Far East	4.1	2.3	2.3	2.4
Europe (Including USSR)	13.2	8.9	8.7	8.9

Egyptian crude output is beginning to show a moderate decline as the result of a cessation of drilling by Socony-Vacuum and Anglo-Egyptian Oil Fields, Ltd. The Asl and Sudi fields on the Sinai peninsula now are drilled up and the companies are unwilling to undertake new exploratory work under the terms of the present Egyptian oil law. Standard of New Jersey interests closed new drilling when the 1948 law was passed.

Farther east, an important development in Indonesia was the opening of the Minas field in Central Sumatra to commercial production. N. V. Caltex Petroleum Mij. completed a 12-inch line from the field to a terminal on the Siak river where oil is being picked up by barges and ferried to ocean tankers at Sungai Pakning. First cargo was lifted from the ocean terminal in May. Caltex has some 33 wells in the field capable of producing considerable volumes of crude. Output in the second quarter of this year was on the order of a million barrels. Elsewhere in Indonesia operations were steady. Some areas still are not open to foreign oil companies because of political unrest.

Soviet Russia appears well satisfied with oil developments on the basis of published reports. The minister for the oil industry has not been criticizing himself recently which suggests that quotas are being met with a margin to spare.

Crude reserves in the USSR now are reported by Soviet officials at 30 billion barrels compared with seven billion barrels in 1938. This is considered by western oil men to be an absurd figure.

While outputs of older fields in the south and west have been declining, the eastern districts have been more than making up the deficiency. An exception to the decline in the south is the off-shore Caspian development which is said to be greater than the quota.

1951 production of oil from offshore wells in the Caspian region exceeded 1950's total by 30 percent. In announcing this figure, *Pravda*, the Moscow daily newspaper, stated that 1951 petroleum production in the Bashkir area outstripped the 1950 record by 23 percent. An additional increase of 23.7 percent is planned for 1952.

A recent open letter to Stalin published in *Pravda* states that the new field in the Tatar republic in the northern Ural-Volga area will exceed the plan in 1952 by at least 700,000 barrels. The plan had assigned to Tataneft a goal 68 percent higher than 1951 production. Production

TO 12,000,000 BARRELS DAILY TOTAL

of individual fields in the "second Baku" has not yet been announced, but it has been reported that this region now produces about 300,000 barrels of crude per day, nearly 40 percent of the USSR total.

Russian crude production in 1951 was announced at 42.4 million tons, nearly 850,000 barrels daily. The previously announced quota for 1960 was 60 million tons, but recently it has been thought that this goal would be achieved by 1955.

Crude production in Poland averaged about 3,600 b/d in 1951 and current plans are to increase this by 36 percent in 1952 as a result of an increase of a third in drilling activity. Recently 30 drillers were graduated from a two year course in Russian drilling techniques. These workers are to be assigned to help expedite the drilling program.

Austria also has been reasonably successful in its operations. Estimates are that current output is around 42,000 b/d, slightly above last year.

Czechoslovakia is reported producing about 2,500 b/d of crude compared with 1,900 b/d in 1951 and 900 b/d in 1950.

Hungarian output now has started to slide quite definitely. Current output is reported at 9,500 b/d compared with about 11,000 b/d last year. The Lovaszi Petroleum National Enterprise recently announced that it expected to exceed the quota for this year by 14,000 barrels, about 40 b/d. A refinery is being built at Szoeny to process Hungarian and Czech crude.

Hungarian gas production will be increased by 20 percent this year, to enable 9,000 new customers to be added to the network for which 23 kilometers of pipe line have to be laid. This work is to be done under the direction of the Communal department of the city council of Budapest.

The situation in Romania appears somewhat clouded. Official reports suggest that there has been a substantial increase in production to a level slightly above 100,000 b/d. Estimates in the industry on this side of the Iron Curtain place output at around 85,000 b/d.

The drive to recover and recondition old drilling and refining equipment is said to be especially successful in the Bacoi fields, from which Scanteia reported savings of 87,500 new lei (the official rate is 11.09 new lei to $1) by reconditioning of electrical equipment, motors, and compressors.

Romania Libera, in its top story of March 12, 1952, asserts among other things that liquid fuel must be saved in favor of solid fuel. Gas oil is to be replaced by coke, which is available in amounts sufficient to supply 50 percent of industry's requirements.

A trade agreement with Romania was signed by Albania on March 26 under which Albania will ship ore, wool, and copper to Romania in exchange for oil. The Albanian government's 1951 plan for petroleum production was only 95.2 percent fulfilled at 3,000 b/d. Oil imports increased to 7,000 b/d according to the Albanian Statistical Directorate.

A half year saw steady efforts in Western Europe to develop indigenous crude supplies. Good progress was made in both France and Germany. A favorable showing was encountered in Denmark.

Increased drilling activity in France and French Morocco has increased crude output in both regions. In the first quarter of this year daily average output was 8,400 barrels in the two areas compared with 7,500 b/d in 1951. Current output is still higher.

In 1951 eleven companies actively engaged in drilling operations in France, North Africa, and Equatorial French Africa, 320,000 feet of hole being put down in France proper and 458,950 feet in Africa for a total of 778,950 feet. This compares with 746,592 feet drilling in 1950.

In France, 12 heavy rigs, nine medium rigs and three light rigs were in operation; in North Africa seven heavy, six medium, and five light rigs were at work; and in Equatorial French Africa there were one light and two medium rigs.

As of January 1, 1952, six companies had six seismic, two gravimetric and one magnetic exploration party in the field in France proper; in North Africa five companies had six seismic, seven gravimetric, and one magnetic party; and two companies in French Africa had three seismic, two gravimetric and three magnetic parties.

Production figures for France and the French Union showed a total production of 376,536 metric tons of crude oil, 9,803 million cubic feet of gas, 11,462 metric tons of liquid products and 14,784 metric tons of gasoline.

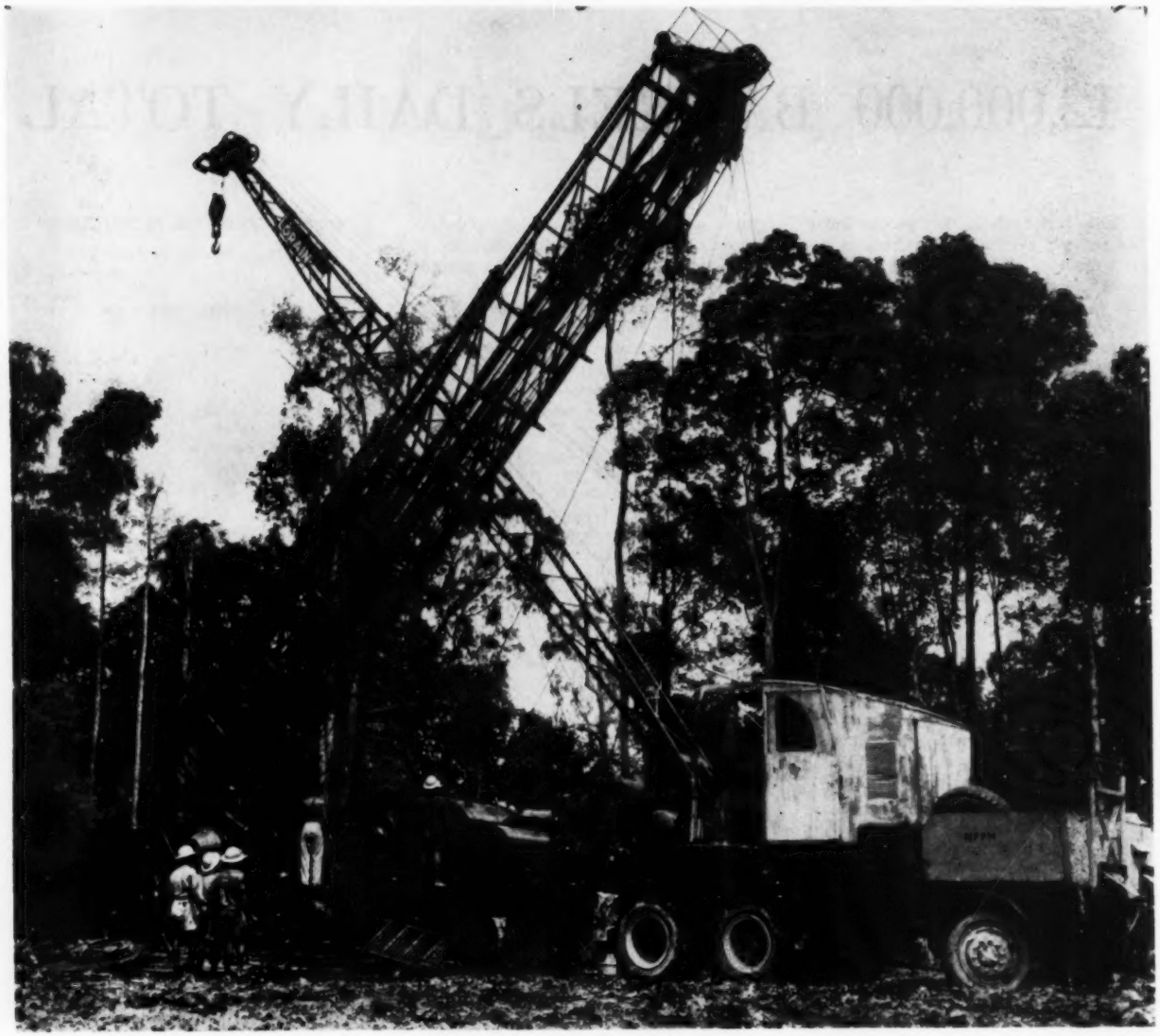
New production has been found in the Carmague district near the hamlet of Galician on the banks of the Canal du Rhone, south of Nimes, where a wildcat well struck oil at a depth of 6,020 feet in Oligocene and flowed 700 barrels a day.

In the Lacq field, where a number of wells have been producing from a depth

WORLD CRUDE OIL PRODUCTION

(Thousands of Barrels Daily)

	1949	1950	1951	Six Months 1952
NORTH AMERICA				
United States	5,046.0	5,407.0	6,149.0	6,006.5
Canada	57.5	78.3	130.5	133.1
Mexico	167.0	199.0	216.0	218.0
Total North America	5,270.5	5,684.3	6,495.5	6,357.6
SOUTH AMERICA				
Venezuela	1,321.4	1,498.0	1,704.6	1,827.9
Colombia	81.5	91.0	106.2	106.0
Argentina	63.5	64.0	66.9	66.0
Trinidad	56.5	56.5	56.7	57.3
Peru	40.5	41.2	44.0	44.4
Ecuador	7.2	7.2	7.4	7.8
Bolivia	1.9	1.7	1.4	1.5
Cuba	0.3	0.3	0.3	0.3
Brazil	0.3	0.8	1.9	2.0
Chile	0.4	1.7	2.0	2.0
Total South America	1,573.5	1,762.4	1,991.4	2,115.2
WESTERN HEMISPHERE	**6,844.0**	**7,446.7**	**8,486.9**	**8,472.8**
EUROPE				
Romania	85.0	88.5	89.0	85.0
Austria	25.0	28.4	44.0	42.0
Germany	16.3	21.6	26.5	32.0
Hungary	10.3	11.5	10.5	9.5
Poland	3.3	3.3	3.7	3.8
Netherlands	11.8	13.4	13.6	13.9
Albania	2.5	3.0	3.0	3.0
France	1.1	2.5	5.6	6.5
French Morocco	0.4	0.8	1.6	2.0
United Kingdom	0.9	0.9	0.9	1.1
Czechoslovakia	0.8	0.8	1.9	2.5
Yugoslavia	1.5	2.6	3.2	3.2
Italy	0.2	0.2	0.4	0.9
Total (excluding USSR)	159.1	177.5	203.9	205.4
USSR	690.0	760.0	842.0	860.0
Total Europe	849.1	937.5	1,045.9	1,065.4
NEAR AND MIDDLE EAST				
Iran	561.0	665.5	360.0	32.0
Saudi Arabia	477.0	546.7	761.5	858.9
Iraq	85.0	136.2	174.6	278.9
Kuwait	242.0	345.0	563.0	736.5
Bahrein	30.0	30.0	30.0	30.0
Qatar	——	33.7	49.6	63.3
Egypt	43.5	45.3	44.7	45.4
Turkey	0.3	0.2	0.5	0.5
Total Near and Middle East	1,438.8	1,802.6	1,983.9	2,045.5
FAR EAST AND OCEANIA				
Indonesia	115.9	132.5	151.7	154.0
British Borneo	70.5	84.8	103.0	106.0
New Guinea	4.8	4.8	4.8	4.7
India	5.3	5.3	5.3	5.2
Pakistan	2.6	3.5	3.6	3.0
Burma	1.0	1.6	2.2	2.2
Japan	3.7	5.6	6.5	5.6
China	2.0	2.0	2.0	2.0
Total Far East and Oceania	205.8	240.1	279.1	282.7
EASTERN HEMISPHERE	**2,493.7**	**2,980.2**	**3,308.9**	**3,393.6**
WORLD TOTAL	**9,337.7**	**10,426.9**	**11,795.8**	**11,866.4**



Raising portable oil well drilling rig, Minas field, Sumatra, where the Caltex Pacific Oil Co. has begun the commercial production and shipment of oil.

of 2,000 feet, a deep hole was sunk to 11,800 feet and for two months blew out an average of six million cubic feet of gas a day, with some oil, before it was finally killed. This is considered to point to deep production from the Jurassic.

Danish American Prospecting Co. recently recovered a core from its Tonder test in South Denmark which geologists find very interesting. The well has not been completed as a producer, but the company expects to do further test work in a 100-foot section where shows were encountered below 10,000 feet.

Germany continues an active drilling campaign and has developed a production of well over 30,000 b/d, about a third of Western Germany's requirements. Drilling is at the rate of about 110,000 feet per month of which nearly a third is in wildcat tests. Last year an offshore test was unsuccessful. Best results have been obtained by searching in Hannover. Proved reserves at the end of 1951 are believed to be higher than the 194 million barrels blocked out at the end of 1950.

In the western hemisphere crude output was slightly higher than a year ago despite the loss of production in the United States during May. The shortage was largely made up by Venezuela and Canada, the most active areas outside the United States.

Canadian crude production still is highly seasonal because of the five-month winter tie-up of shipping from the Lake Superior terminal of the Interprovincial pipe line. From a high of about 170,000 b/d in August, 1951, production dropped to about 100,000 b/d last February. Now that the pipe line is taking about 83,000 b/d for delivery to the east, production has risen to a new high in excess of 180,000 b/d. June nominations for Alberta crude totaled 186,260 b/d. Imperial Oil Ltd. stated its needs for the pipe line and for local refining at 144,310 b/d.

With oil and gas discoveries running at the rate of about 15 per month so far this year, wildcat operations are expanding. In May there were 253 active rotary rigs in Western Canada. This was an increase of 40 rigs over April and of 100 rigs over May a year ago. Most of the exploratory work is being done in Alberta although activity in Saskatchewan and British Columbia is also increasing.

In 1951 Mexico drilled 268 wells with a combined footage of more than one mil-

lion. This year Pemex is seeking to drill 400 wells with increased emphasis on wildcatting. Last year only 18 of the 268 wells were wildcats. Two were successful and 16 dry. Development drilling was centered in Poza Rica which produced 70 percent of the nation's oil in 1951. The Jose Colomo field now is to be intensively developed.

Mexican American Independent Co., (CIMA) has spudded in a wildcat well on a structure known as Minatitlan in the Isthmus of Tehuantepec region, State of Veracruz. Selection of the location, only about nine miles southwest of the Rabon Grande field discovered by CIMA last year, was based on seismic work recently completed. In addition to exploratory drilling on Minatitlan, the development of Rabon Grande is proceeding rapidly. The field is currently producing upwards of 180,000 barrels per month.

Venezuela production in the first half of 1952 increased 12.4 percent over the same period last year to 1,838,000 b/d. With more than 100 rigs active, the trend of output has been steadily upward throughout most of the period. Recently a sort of plateau seems to have been reached.

In 1951 the industry drilled 1,076 wells as compared with 655 the previous year. This year it appears likely that completions may approximate 1,500. Recently about 100 new wells per week have been brought in. At the end of 1951 there were 9,942 wells capable of producing.

Search for new reserves is continuing at a very high pitch of activity. Indications of this are an increase in exploration field parties and a parallel increase in exploration drilling. Field parties, for example, worked a total of 44 party-months in March 1952, as against 36 in March 1951, for a gain of 22 percent. Seismograph accounted for 20 party-months, surface geology 18, while gravity meter and structure drill trailed with three party-months each. Drilling rigs in operation increased 28 percent between April 1951 and April 1952, from 87 to 111 rigs. Exploitation rigs went from 65 last year to 80 this year, but exploration rigs rose 41 percent, from 22 to 31. Of the total rigs, Mene Grande operated 35, or 32 percent; Shell operated 30, or 27 percent; and Creole 17, or 15 percent; while eight other operators worked the remaining 26 percent with 29 rigs.

Oil is being discovered in Venezuela much faster than it is being produced. In 1951, total production was 622.2 million barrels and reserves increased 932.8 million barrels to 9,031 million barrels. Ratio of production to reserves was 6.9 percent. Based on the current success ratio of drilling in Venezuela, it is anticipated that reserves will be well over ten billion barrels at the end of the current year.

The government has not yet acted on the large number of applications for new oil concessions now on file. At the end of 1951, concessions totaled 15,549,000 acres. This is thought to be about 17.7 percent of the area suitable for oil exploration. About 90 percent of the acreage in concessions now in force is held by seven companies. Creole Petroleum Corp. holds 22.5 percent of the area, Shell Companies 20.4 percent, Mene Grande 15.7 percent and Socony- Vacuum 12 percent. It is understood that a considerable number of newcomers are hoping to enter the country when leasing again is begun.

The areas held by the several operators in Venezuela as of December 31, 1951 are as follows:

	Thousands of Acres	Percentage
Creole	3,495	22.5
Shell Co's.	3,175	20.4
Mene Grande	2,448	15.7
Socony Vacuum	1,860	12.0
Texas-Mercedes	1,269	8.3
Sinclair	1,207	7.8
Venezuelan Atlantic	795	5.1
Richmond	627	4.0
Esperanza	189	1.2
Phillips	178	1.1
Pantepec	124	0.8
Compania Espanola	98	0.6
Others	84	0.5
Total	15,549	100.0

The minor individual changes that took place during 1951 were mainly the result of relinquishments or, in some few instances, of transfers between concession-holders. In view of the government's strict policy against the granting of new concessions (in effect since 1943), the net result is a constant yearly shrinkage.

In this connection, an unusually well-informed article signed by Arthur Hidalgo R. appeared recently in *"El Universal"* of Caracas, under the title "Granting of Concessions." Senor Hidalgo pointed out that scarcely one percent of the area of concessions granted in Venezuela to date has been productive, and that the 15.5 million acres presently held cannot be expected to give a much better yield; that geology is by no means an exact science, and that the oil business is full or risks; that the Venezuelan nation, on the other hand, is a partner without risk in the oil industry; that while the Soviet Embassy would undoubtedly celebrate the occasion with a party, it would be disastrous for all concerned if the companies renounced the acreage they now hold; and that, in short, there is a real necessity for the granting of new concessions.

For the first time in many months, Venezuelan production fell slightly in March, when the daily average was 1,820,-154 b/d as compared with 1,828,421 in February. Whether this setback to the year-long trend toward setting new records every month is fortuitous, or the beginning of a reversal, remains to be seen. In the week ending May 19, a new record high of 1,850,000 b/d was established; but even this figure is some 30,-000 b/d lower than the theoretical figure that projection of the earlier rate of increase would give.

Detailed figures for the operating companies for March follow:

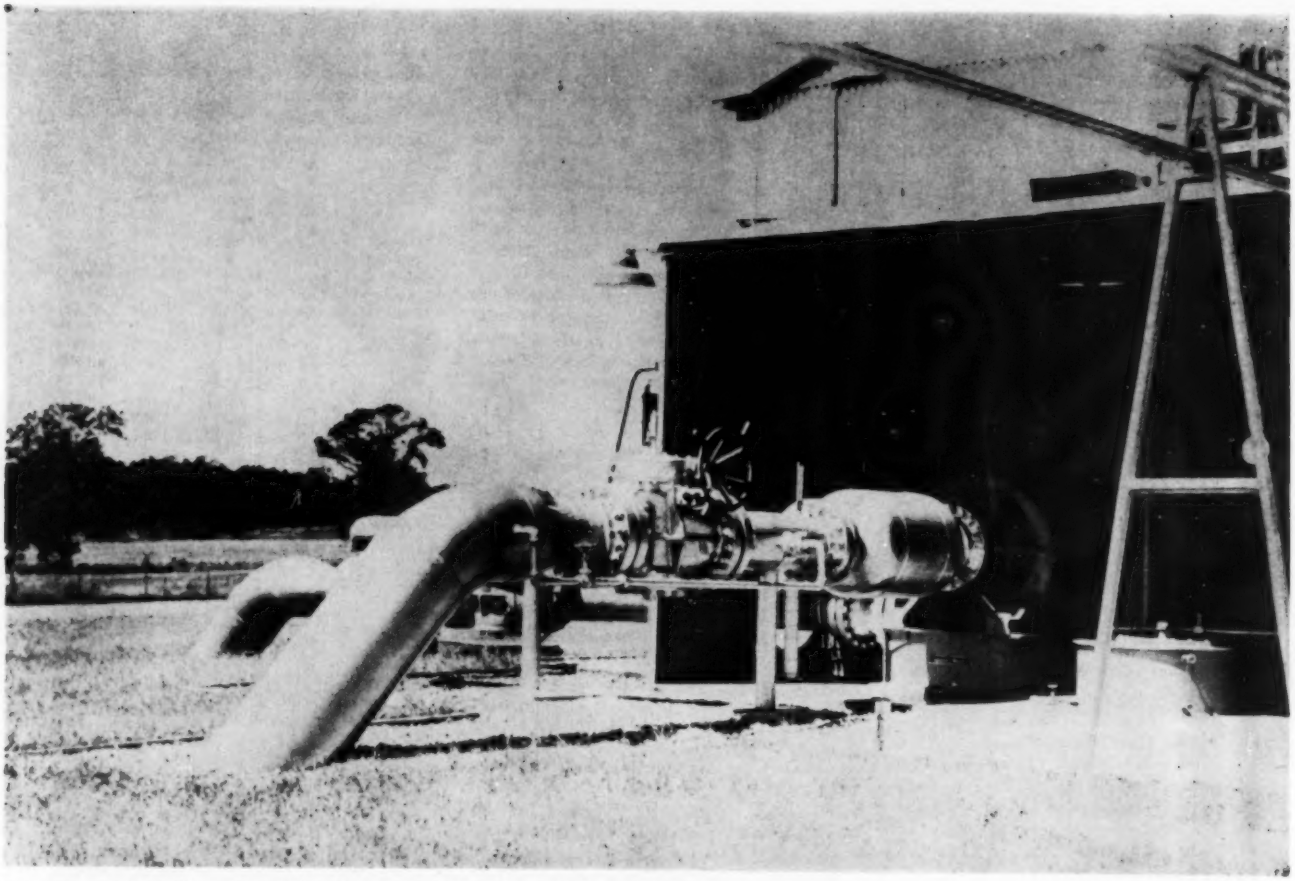
	Eastern Venezuela	Western Venezuela	Total
Creole	118,278	646,774	765,052
Shell Co's.	—	573,341	573,341
Mene Grande	252,174	59,231	311,405
Socony-Vacuum	57,798	—	57,798
Texas-Mercedes	35,437	8,044	43,481
Atlantic	17,146	—	17,146
Richmond	—	16,279	16,279
Sinclair	13,539	—	13,539
Phillips	12,728	—	12,728
Pantepec	8,427	—	8,427
BCO, Ltd.	—	958	958
Total	515,527	1,304,627	1,820,154

Preliminary reports indicated that April's figure would be about 1,830,000, or only slightly higher than February's. It may well be that Venezuela's production has reached a plateau and will level off at present rates.

An important completion in the first half of the year was Creole's Mara field well, MA-11, completed at 10,697 feet in April for 11,500 b/d. This is one of the biggest wells yet drilled in this area, where prolific Cretaceous limestone production was first encountered about 1945. In this very complex field, not all wells are of Middle East proportions, and MA-11 is located within a mile or less of similar deep wells, drilled to the same horizons, which produce considerably less than 100 b/d. The Mara field in 1951 produced 6,364,072 barrels of 30 gravity oil, or an average of 17,436 b/d, for Creole alone; for Shell, 32,876 b/d; for Mene Grande, 10,038 b/d; and for Texas 13,855 b/d—a total of 27,084,000 or 74,205 b/d.

Production in Colombia has been largely unchanged at about 106,000 b/d during the first half of the year. Outstanding operation has been the drilling by International Petroleum Co., Ltd., of a step-out to its earlier Cretaceous discovery in the middle Magdalena valley. At the end of April the company announced completion of Totumal No. 2 as a producer of 75 b/d of 33 gravity crude. The well was drilled about three quarters of a mile northeast of the original discovery, but is believed to be separated from it by faulting. The discovery was rated at 1,100 b/d of 27 gravity crude. International plans to bring in a heavier rig so that the third test may be drilled to the lower Cretaceous. The Totumal discovery is considered of importance since it is the first to find the Cretaceous in that part of Colombia.

With output of United States wells again restored to a normal level by settlement of the strike, world production will again approximate 12 million barrels daily. Capacity is adequate to meet consumer demands from a crude standpoint. The loss of refinery throughput during the strike will not be made up as easily as will the loss in crude production.



Compressor station at Farmington, Mo., showing gas inlet and centrifugal compressor.

Contributions Of the Gas Turbine To Big Inch Gas Line Pumping

CENTRIFUGAL compressors driven by gas turbines will have special value in the movement of natural gas through large diameter lines, according to a paper presented at the recent Atlantic City meeting of the American Society of Mechanical Engineers by T. J. Putz of Westinghouse Electric Corp. The first large gas turbine for gas line service was installed in 1949 and now that substantial operating data have been assembled, other units of similar size have been ordered and one 5,000 hp turbine is being constructed by Westinghouse.

In his ASME paper, Mr. Putz reported that there now are 100,000 miles of main gas lines with an installed or authorized horsepower of 2,700,000. Recently the trend has been toward the installation of larger and larger lines.

In 1945 there were 1,000 miles of gas pipelines above 25-inch diameter out of a total 61,100 miles. Currently there are over 17,000 miles of gas pipelines 25 inches and above either installed or authorized. The first 30-inch transmission line was placed in service in Southern California in 1947, and the longest pipeline in the world, also 30 inch, was placed in service early in 1951 by the Transcontinental Gas Pipeline Corp. This line is

1,840 miles long and extends from the Rio Grande to New York City. The first 34-inch line is being completed by Pacific Gas & Electric Company. To date, no 36-inch line has been constructed, although Transcontinental Gas Pipeline Corp. has considered the looping of its present 30-inch line with one of that size. Pipe of 36-inch diameter can be manufactured and is available in welded seam pipe.

In the past the major portion of the compressor horsepower requirements have been supplied by reciprocating type compressors driven by direct-connected reciprocating gas engines. Gas compressors were located in stations spaced from 75 to 100 miles apart and the gas would be compressed to a pressure ratio of between 1.5:1 to 2:1. These high compression ratios heated the gas sufficiently to make it economical to cool the gas before returning it to the line in order to maintain line capacity. By reducing the station spacing, lower compression ratios are required and the need for gas cooling eliminated. The horsepower necessary to pump a given amount of gas can be reduced 25 to 40 percent with closer station spacing.

Mr. Putz stated in his paper that comparative studies have shown that 26-inch O.D. pipeline could be economically developed to the same delivery capacity with a gas turbine driven centrifugal compressor as a 30-inch line with reciprocating engines. The optimum station spacing was found to be 40 miles using the gas turbine centrifugal compressor with a pressure ratio of 1.24. The optimum spacing for the conventional direct-driven reciprocating gas engine unit was 80 miles, with a pressure ratio of 1.54.

A 1,000-mile 26-inch line would require $8,000,000 less capital investment, 64,500 tons less steel, and could be operated with a reduced transportation cost of approximately 0.8 cent per thousand cubic feet or a $1,360,000 reduced annual cost.

A second study showed that the addition of centrifugal compressors in the 30-inch line between reciprocating stations would economically increase the capacity of this hypothetical line from 550 million cubic feet per day to 670 million cubic feet per day.

Westinghouse placed in service in May, 1949 a 1,800-hp gas turbine driving an Ingersoll-Rand direct-connected centrifugal gas compressor in a test station on a natural gas line at Wilmar, Ark. This was the first such installation in the world and the first industrial gas turbine in the United States operating with natural gas fuel. This test installation was on the 22-inch line of Mississippi River Fuel Corp. connecting Monroe, Louisiana with St. Louis, Mo. It is located approximately midway between two conventional engine driven stations at Crossett and Glendale. This location provided great flexibility in that it gave an opportunity to test the gas turbine and the centrifugal gas compressor over their entire operating ranges.

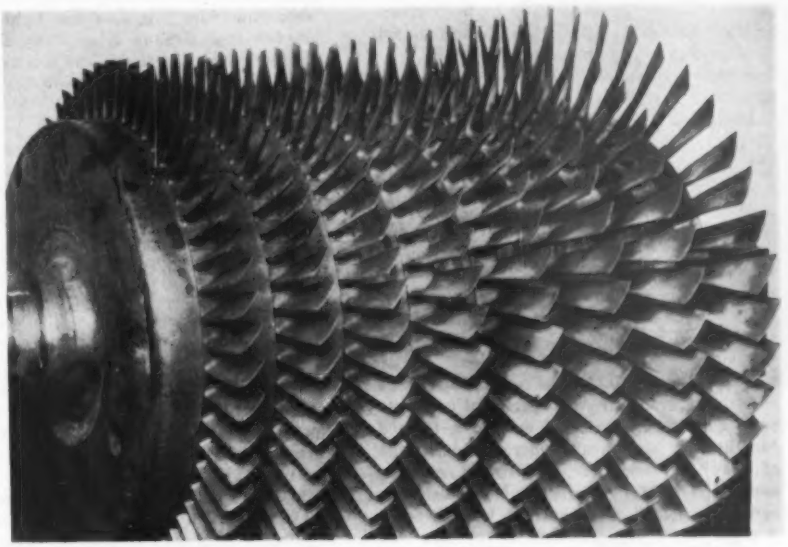
The unit was operated at the Wilmar location until the Fall of 1950. At that time the Mississippi River Fuel Corporation completed installation of a parallel high pressure line, which eliminated need for the unit in this location. It was then moved to Farmington, Mo., approximately 60 miles below St. Louis, and placed in service January, 1951. At this new location it is used to "pack" the underground storage field recently acquired by this company in the vicinity of St. Louis.

Mr. Putz reported the following advantages have been realized: light foundation required, small station housing, few auxiliaries, low auxiliary power consumption, low lubricating oil consumption, no water required, simple piping to and from station, no gas line pressure pulsations and the system lends itself to automatic operation.

The experience gained from this installation has proved that this type of gas turbine is excellent for booster service. The simplicity and small size allows for a simple low cost station, and it can readily be moved to various locations. It can be shut down for extended periods without the expense of providing special protection and can be later restarted quickly and without difficulty.

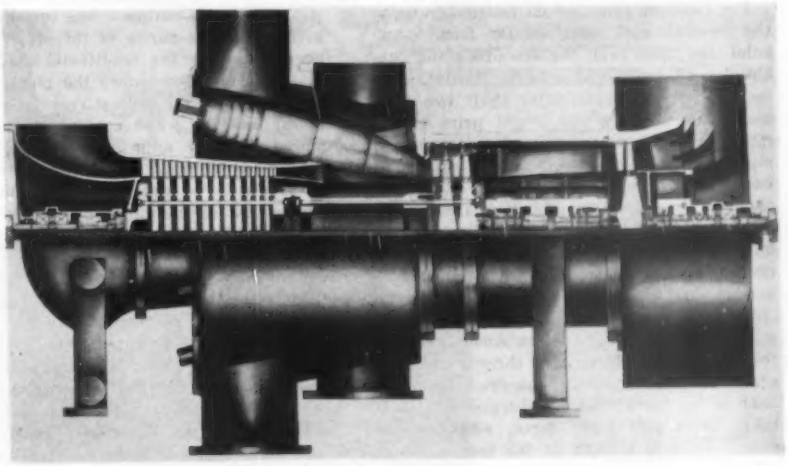
Based on the operating experience gained with the 1,800 hp simple single shaft unit, Westinghouse is building a 5,000 hp dual shaft gas turbine with regenerator. The unit will have an 11-stage axial flow compressor, six combustors, two-stage compressor drive turbine and a single stage power turbine. With this arrangement the power turbine and gas compressor speed and load can be adjusted to suit varying pipeline flow conditions. The speed of the compressor and the compressor drive turbine is 6,200 rpm, while that of the drive turbine is 6,500 rpm at nominal full load power rating. The regenerator which recovers approximately 75 percent of the available heat in the exhaust gases is of the extended surface type.

Mr. Putz concluded that the contribution the gas turbine can make to the major gas transmission systems in lines 20 inches and larger in diameter will be in the form of reduced capital investment for stations and lines and a lower cost per unit of gas transported. In specific cases, additional advantages will arise from station simplicity, freedom from large water supply problems, reduced maintenance and ease of adaption for remote control or unattended operation. In addition, the gas turbine's characteristic of increasing power with low ambients gives it extra rating in the winter months when the demand for gas is greatest.



Above, 1,800 hp gas turbine rotor after 5,000 hours of pipeline operation.

Below, longitudinal section of 5,000 hp unit now being constructed for gas pipe line.



Heaters employed to maintain fluidity of heavy fuel oil stored in feldspar mine.

Underground Oil Storage Proved Practical

By Rodger L. Simons

UNDERGROUND storage tanks for light products washed out of salt beds in the southwestern part of the United States had predecessors in Sweden where both heavy fuel oils and lighter products have been stored underground for several years. In Sweden ground water has been used to prevent migration losses, there being no impervious salt beds at convenient locations.

Sweden is a country whose own oil deposits, primarily in the form of shale, are entirely inadequate for her own needs in either peace or war. Thus she has long been faced with the problem of providing sufficient storage for the large quantities of oil needed for steam plants of the Swedish State Power Board. This led Harald Edholm, director of supplies for the board, to develop the idea of using old mines for oil storage. Small-scale experiments confirmed his conviction that oil could be stored on a water bed and that the subsoil water would act as an effective caulking medium and forestall the escape of oil by seepage through cracks in the rock.

After several years of experiment and tests on a commercial scale, he evolved a method for the safe and cheap underground storage of heavy oil and, more recently, of gasoline and light oils, in old mines and in reservoirs specially blasted in the hard rock of Sweden. A prerequisite to the success of the plan was that these cavities be located below the upper level of the subsoil water and that the water have sufficient pressure to hold the oil and prevent its escape.

For the first plant an old feldspar mine on the Swedish east coast not far from Stockholm was taken over, the loose rock and rubble cleaned away, and a heavy concrete roof installed. A separate water shaft was sunk and connected with the lowest point of the mine and with the nearby bay through a pipe line. To assure an ample supply of water for subterranean flooding, a number of well bore-holes were drilled around the mine. A pump house and heating station was built 98 feet down in the mine and connected through a pipe line with a tanker pier and another small pump house on the bay.

The first oil delivered into the new cistern was 3,000 tons brought by an American ship, followed a fortnight later by three more tankers. Since then several hundred thousand tons of oil have been discharged into and taken from this giant depot, where oil is stored down to a depth of 262 feet.

When the reservoir is completely filled, the oil rests on a shallow layer of water at the bottom, which is raised as the oil is pumped out. This keeps the upper oil stratum at a suitable level for the pumps. Should it be desired to empty the cistern entirely, a special "skimming flume" is used for removing the last few inches of oil from above the water blanket without letting any of the water enter the pumps. A special row-boat is used by the inspectors who check this subterranean lake.

Operational experiences have revealed several unanticipated advantages in the new system, prominent among them being the large measure of fuel economy which is achieved. Unlike the case of an ordinary steel tank, in which oil cools very rapidly, in the underground cistern oil holds its heat for long periods. A thermometric system permits the reading at one central control panel of the oil temperatures at 32 different levels throughout the mine. Thus readings show that the temperature of the bottom layer has gradually risen from 32° F. to 41° F. and that the upper layers, which receive the oil at temperatures of 86° F. to 95° F., lose the heat so slowly that even after a long time in storage it does not sink below 60° F. Thus when the oil is to be delivered from the reservoir it requires a minimum of heating. This takes place in a small rock chamber, in combination with a new system for cleaning the oil.

The warm oil at delivery level largely cleans itself of water and impurities, which gradually sink to the bottom. Due to the high degree of relative purity of the oil, it requires no cleaning by the traditional arrangement of filters installed before the pumps. Tests carried out during several years of operation reveal that the water content of the oil removed from the mine is lower than that of the oil put in, despite its having been stored in proximity to water. Though the water pumped out of the mine has a slight odor of chemicals, it contains no oil and deposits no oil slick when discharged into the adjacent bay.

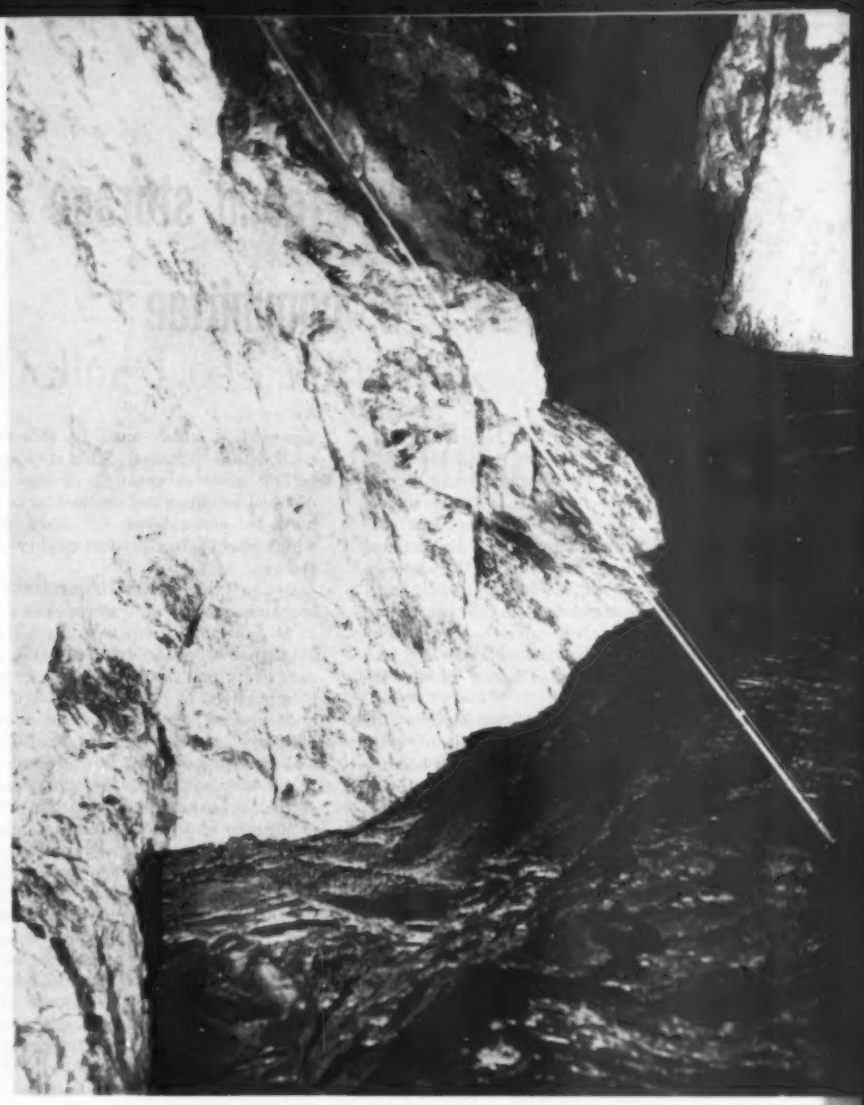
Including machinery, pipe lines and pier equipment, this plant cost $700,000, as contrasted with an estimated $4,000,000 for an underground steel tank of comparable volume. The price per cubic foot of storage capacity has amounted to 14 percent of that for an ordinary underground cistern, exclusive of the cost of the pier, which would be involved in either case. As maintenance costs have been extraordinarily low and as the large capacity of the reservoir permits purchases to be made when prices, freight rates and delivery times are most favorable, it is estimated that this first underground oil depot has already saved its owners something like $6,000,000.

Encouraged by the success of this first large-scale plant, Mr. Edholm began adapting his system to the storage of gasoline and light oils immiscible with water. This has been done with specially blasted-out rock chambers having the approximate contour of a gigantic bottle. It is called the Viaco system and as in the case of the heavy oil reservoirs, the gasoline is pumped directly into an uncaulked rock chamber, where it rests on a layer of water. At the top the so-called bottle is corked by a stopper of concrete covered with an open water lock located below the upper level of the surrounding subsoil water. Through an arrangement of automatically controlled pumps the water level in the tank or "bottle" is regulated and the system held in balance, either through an open side shaft running to the bottom of the cistern or through a tube entering at the top, together with the oil pipe itself. If the level of the ground water drops, additional water is added to maintain a constant over-pressure of the subsoil water in relation to the gasoline being stored.

As the gasoline is sealed in by water, it is subject to no leakage. Moreover, as air cannot penetrate during filling, storage or removal, the usual very considerable loss through evaporation of the gasoline is said to be largely eliminated, as are risks of fire and explosion. A plant of this type is practically bomb-proof, making special shelter arrangements unnecessary. And aside from pumps and pipe lines, it is practically maintenance-free and requires a minimum of operational attendance.

It is thought that the combination of gasoline and water may offer advantages in the storing of gasoline and light oils for an extended period of time. Samples of gasoline withdrawn from the cistern after four months showed that the product was still water white while a control sample taken from the same initial consignment at the time of delivery and kept in a dark room for the same period had turned yellow. An analysis of the rock-stored sample was made by the Swedish Nynas

Swedish underground fuel oil storage. Bottom leakage is prevented by a water table and side leakage by appropriately regulated ground water level.



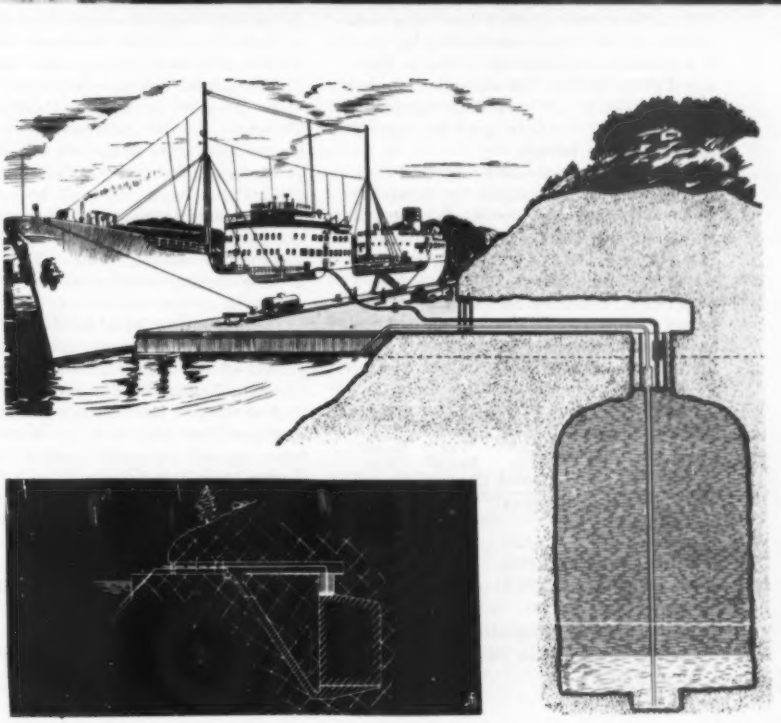
in Sweden

refinery and even showed that the color had improved from 2.5 to 1.25 units on the scale used for the tests. The explanation given for this situation is that the subsoil water dripping through the gasoline absorbs some of the latter's sulfur and resins. Comparative tests established that no changes whatever had occurred in respect to water content. Distillation curves remained constant.

As no attention has to be devoted to the length of time the fluid is in storage, the Viaco system is seen as encouraging and facilitating purchase of the product when prices and transport are favorable. Moreover, the storage owner does not have to bother about periodic emptying of his tanks.

Construction costs for a Viaco tank in the capacity range from 100,000 to 1,000,000 cubic feet are higher than for ordinary surface steel tanks of comparable volume. On the other hand, the "bottle" tank is cheaper than the systems hitherto used for the storage of oils underground in either steel or concrete tanks imbedded in rock. Moreover, the annual storage costs are said to be only 30 to 40 percent of those for conventional surface cisterns. This difference is due primarily to elimination of losses through evaporation, which, in Swedish experience, amounts to about 65 percent of the storage costs. Obviously these figures vary according to the number of fillings per year, the price of the oil, the depreciation period for the tanks and plant, and other factors. In any case, it is affirmed that the annual cost for storing of gasoline in Viaco cisterns works out as lower than with other systems.

In the matter of heavy oils, the Viaco bottle-like cistern offers the same economy of lowered heating costs that was cited in connection with storage in the abandoned feldspar mine, as well as cheaper maintenance costs and lower insurance premiums, which in Sweden are only about 30 percent of those for surface tanks. Moreover, in face of the steel shortage which grips the world, an added advantage of the Viaco "bottle" reservoir is that it can be built without resort to expensive and inaccessible steel plates.



Two versions of the Swedish underground storage system for petroleum products. In the upper drawing the water level is regulated through a tube entering the tank through the upper closure. A separate water shaft is provided for the tank diagrammed below.

Feasibility of underground storage studied by N. P. C. committee

AT THE REQUEST of the Interior Department, the National Petroleum Council has made a study of the feasibility of storing petroleum and products underground. An NPC committee has concluded that such storage can be installed with attendant economies of manpower and steel and with a desirable safety factor. It recommended that a continuing study be conducted under the direction of state geologists with data assembled and disseminated to the industry by the Interior Department.

Use of underground formations for storage in the United States is of quite recent origin and was undertaken because of the very high winter/summer ratio of demand for liquefied gases.

The first project of this type that demonstrated a storage efficiency equivalent to steel tankage was a 7,000-barrel reservoir washed out of the Western Saline section at Kermit, Texas in 1950. Since that time more than seven million barrels of such storage have been created or are under construction, the majority of which is in New Mexico, Texas, Oklahoma, Louisiana, Mississippi, Kansas, and Michigan.

In some areas, where water soluble rocks are at great depths or are not present, underground storage has been constructed or is under construction by mining operations principally in shale. Phillips Petroleum Co., for example, is mining a very large cavity in shale formation for storage of propane near the end of its pipe line in Illinois.

The committee prepared a general comparison of cavities created by dissolving salt, cavities created by mining, atmospheric surface storage and pressure surface storage with respect to cost per barrel of storage, pounds of steel per barrel of storage, and man hours required per barrel of storage. In general, for 100,000 barrels of storage, the following table reflects these comparisons:

Type of Storage	Cost Per Barrel	Steel Per Barrel (Pounds)	Labor Per Barrel (Man Hours)
Pressure Surface	$20.00	98	1.26
Atmospheric Surface	1.09	7.5	0.07
Dissolved Salt	0.75	1.5	0.11
Mined Cavities	4.50	2.2	0.37

The technical subcommittee stressed in its report that it was dealing in broad generalities which must be followed up with detailed studies. Such studies must include costs of creating cavities at individual locations and contaminants which may be encountered or other factors which might affect product quality during storage.

One of the factors important in the economic success of underground storage in salt formation will be the relationship between the cost of drilling to the necessary depth and the size of the cavity that it is practical to create at that depth. Any underground storage venture must be carefully explored by means of drilling and extensive study of recovered cores for the determination of their physical and chemical characteristics and the presence or absence of objectionable contaminants. These may be sulfur, hydrogen sulfide, hydrocarbon gases, and hydrocarbon residues.

Other factors that must be taken into consideration, in order to guard against deterioration of certain products in storage, are the effects of time and temperature, which even in the absence of oxygen, can cause certain components to polymerize and degrade the performance quality of refined products.

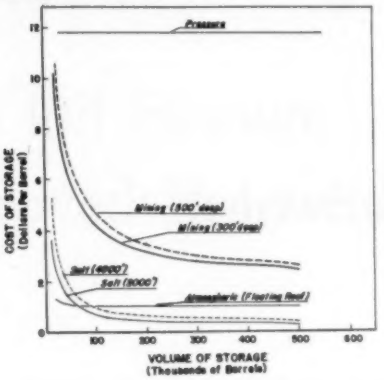
Since it appears desirable that every underground reservoir should have a domed or vaulted roof with a relatively steep inclination, it may prove unsafe to allow the horizontal dimensions of such reservoirs greatly to exceed their height. Therefore, in the construction of underground reservoirs in bedded salt deposits of limited thickness, relatively small individual reservoirs only will be practical. The economic advantage of such construction will finally disappear with depth of overburden, making such attempts inadvisable unless economy of steel or manpower, as such, should dictate the attempt.

The committee considered safety factors from a number of angles, including safety of the public and safety of the products themselves. It was recommended that cavities be built outside the limits of municipalities and that precautions be taken against escape of product to avoid danger to the public.

For safety, reservoirs should be entirely enclosed in rocks that are effectively and permanently impervious by nature or made so by artificial means, except where the contents will be positively confined by ground water.

In order to guard against possible fracture of the reservoir by internal pressures, each reservoir should be under cover of *more* than one foot of depth for each pound of *total* maximum pressure (hydrostatic plus vapor plus pump) that may at any time exist within it, having due regard to the underground temperature in the locality and the depth considered. The additional thickness of cover that should be provided as a factor of safety must be determined for each individual case, the committee said.

COMPARISON OF COST OF VARIOUS TYPES OF STORAGE



The roof must be in rocks of sufficient strength and designed to preclude dangerous caving or upward fissuring and all connections between the reservoir and the surface should be so sealed as to preclude possibility of any fluid leakage, either upward or downward, at any level. Adequate pressure tests should be made before any petroleum is introduced into the reservoir.

Reservoirs should be well separated from any other underground excavation, actual or potential, to preclude possible intercommunication. This also involves avoidance of rocks that could provide avenues of escape through fissures or permeable strata.

The committee suggested that there are five areas in the United States where cavities may be created by dissolving salt. More than half of the country contains sedimentary rocks which are suitable for mining to create storage space. In five areas storage can be had only by mining hard rocks such as granites, lavas and metamorphics.

It is the committee's opinion that salt cavities are most desirable. In descending order, others are: existing mines, mining of shale, mining of hard rocks, traps in naturally permeable rocks, natural caverns, and last of all, abandoned coal mines. Coal mines present difficulties because of contamination of products and structural weaknesses which suggest that they would prove to be highly unfavorable.

As a whole the committee feels that private companies in the United States will continue their present investigation of the problem because of the economies which may be made and the better service offered customers of seasonal products.

Britain's Dollar Losses From Iranian Seizure Put at $215,000,000

By Joseph Huttlinger

AN ESTIMATE of Britain's dollar losses up to January 1952 appears in a report prepared by Cornelius J. Dwyer, chief of the petroleum section of the Mutual Security Agency in response to an inquiry from Representative Charles A. Wolverton of New Jersey. The calculation does not include losses in operating costs, royalties or expenses paid in other currencies, but only the direct outlay involved in dollar purchases of oil and oil products necessitated by the absence of Iranian supplies. This added dollar outlay is placed at $215 million up to January 1952.

The report points out that until the Anglo-Iranian Oil Co. was forced out of Iran a year ago, the company owned oil wells capable of producing upwards of 700,000 barrels of crude daily and also the world's largest refinery, able to process 550,000 barrels daily of crude and providing 500,000 barrels daily of products for export after taking care of local requirements. The direct loss in production, therefore, was at least 150,000 barrels daily of crude and about 500,000 barrels daily of products. The refinery, however, could meet normal product requirements by running about 510,000 barrels daily of crude which provided 460,000 barrels daily of product for export.

"The refinery at Abadan," Mr. Dwyer notes, "was important not only for its sheer size, but also because it had more than 210,000 barrels daily of residual fuel oil capacity and 96,000 barrels daily of distillate fuel oil capacity, as well as 18,400 barrels daily of aviation gasoline capacity, about 48 percent of aviation gasoline in the free world outside the United States."

The Dwyer report does not translate this production into revenues, but a rough calculation, giving a figure useable for understanding the situation, can be made on the basis that a barrel of product is worth $3, and a barrel of crude oil $1.50. On this basis, the loss of exports of 460,000 barrels daily of products adds up to $1,380,000 daily in dollars or dollar equivalents. The loss of 150,000 barrels daily of crude comes to $225,000 a day. On a yearly basis, this adds up to $585,825,000.

Referring to the steps taken to replace the deficit in supplies, the Dwyer report says, "Upon the shutdown at Abadan, British company refineries elsewhere in the world commenced to operate as far in excess of their normal rate as was feasible, and various modifications were undertaken to increase effective capacity still further. Sales of products to American companies, principally for resale in the sterling area, were eliminated and large quantities of products were purchased from American sources. Products purchases averaged 300,000 barrels daily in September, the high month, at a cost equivalent to an annual rate of expenditure of $365 million."

By January of this year, British refineries had stepped up operations by 250,000 barrels daily over the rates at the time of the Iranian shutdown. At that time, however, British companies were buying 130,000 barrels daily of products, had eliminated sales of 20,000 barrels daily to American companies, and were still shy 60,000 barrels daily of products.

The gain in petroleum output can again be translated roughly into financial terms by assuming $3 a barrel for products; an increase of 250,000 barrels daily thus comes to $274 million a year. Since some of the British crude oil was purchased, an adjustment is needed, lowering the figure to perhaps $250 million. Without assuming complete accuracy, this gives some indication of how far Britain had gone early in the current year toward closing the financial gap.

Referring again merely to dollar costs imposed by Iranian confiscation, the Dwyer report offers a rough balance sheet as follows:

"The current costs to the British of the loss of Iran's output include the costs of purchasing crude oil and products from dollar sources, of diverting tankers from their normal runs, of expanding crude oil production and refinery runs elsewhere and of lost sales to American companies and others.

"Savings include the costs of operation in Iran, which involved a substantial dollar element from the conversion of royalties and other sterling payments. Some of these current costs are in dollars; others appears in the form of sterling EPU credits.

"Dollar costs arising from this loss were probably running at a rate equal to more than $500 million a year in the peak month of September, but have been progressively reduced since then with the expanded output of crude oil and refined products elsewhere.

"We believe that the net dollar loss for the calendar year 1952 will be about $215 million, of which approximately $70 million represents the loss of dollar savings from sales of Iranian crude and products to American companies for resale in their sterling area markets.

"British company crude oil supply is expected to be in line with requirements by the end of 1952, with a further increase over January, 1952, in the British share of Kuwait and Iraq availability of 385,000 barrels daily. Sales of crude oil to American companies for use in sterling area refineries have been resumed and will have reached contract level by that time. Product purchases are expected to be eliminated early in 1953, although the British position will not yet have been fully recovered."

As for the Abadan plant itself, Mr. Dwyer estimates that it would take $900 million in all currencies to rebuild a comparable plant. If the job were done speedily, the dollar element of the cost might be high. If the British were to await delivery of petroleum equipment and materials from sterling areas, the dollar element might be reduced to as low as $135 million.

This is not to say that any British company is known to be planning another refinery of the huge size of Abadan. On the contrary, the plans that have been made call for constructing several smaller plants in Australia, Europe and elsewhere.

SPAIN PLANS OIL SEARCH IN ARAN VALLEY

By Philip Querido

MADRID, SPAIN

AFTER nearly two decades of sporadic exploration, Spanish geologists are again hopeful of finding commercial deposits of oil. Recent discoveries in southern France, just across the Pyrences dividing the two nations, are giving Spaniards renewed faith. Government oil monopoly officials feel that the newly discovered Lacq field in France very probably extends on into Spain's Aran Valley. Although more than a dozen wells have been drilled in the area, and no more than a few inches of oil sands were found, renewed drilling will be undertaken this Fall.

Most of the work is expected to be done by the Compania Espanola de Petroleos, S.A. (CEPSA), a privately owned Spanish company that buys and refines for the Spanish government owned distributing agency, Compania Arendataria del Monopolio de Petroleos, S.A.

CAMPSA was organized in 1928 when the government took over all oil distribution. However, oil companies in existence previous to that year were permitted to continue all other oil operations.

This will not be the first drilling venture for CEPSA. It drilled two wells in the northern Spanish region together with the Socony Vacuum Oil Co. in 1949-50. One was located near Lerida and went down to 7,662 feet. The second location went to 7,254 feet near Burgo de Osmoa, in the province of Soria. After these two wells Socony Vacuum pulled out and a special subsidiary, Compania de Investigacion y Explotaciones Petroliferas, S.A. (CIEPSA) was dissolved.

However, Socony did leave Spain the only modern rig it possesses. Up until 1948 no rig that could drill below 1,000 feet had been available.

Under present plans CEPSA hopes to drill at least three more wells in northern Spain. No definite spudding-in dates have been set, but it is known that geologists are now re-studying the seismographic charts made in 1949 and 1950 to find any possible correlation with the French field.

While CEPSA is officially hunting oil, reports have been circulating in Madrid that it is really looking for gas. If CEPSA finds oil, it will be forced to sell it to the government agency at market price, under an existing agreement. If gas is found, it will be permitted to sell it to whomever it wishes.

Industrial progress in the northern industrial hub of Barcelona has long been retarded by an acute lack of fuel. Should CEPSA find gas, it plans to lay a pipe line to Barcelona where it hopes to get a better return from its products than it would selling crude to the government agency.

Spain's major problem today, however, is the large dollar expenditure it is forced to pay for the importation of petroleum products. Latest figures indicate that Spain spends some $60,000,000 annually for oil products in all forms, of which half is actually paid out in dollars. Today, oil imports are the largest drain on Spain's dwindling dollar reserve and internal consumption continues to rise weekly. In 1950 Spain imported 1,359,491 tons and should ration restrictions be removed, consumption would probably skyrocket to 2,000,000 tons before year's end.

CAMPSA buys its oil mostly from CEPSA, which owns an 18,000 b/d refinery at Tenerife in the Canary Islands. CEPSA in turn buys its 300,000 tons yearly mostly from Middle East sources.

Another large domestic supplier to CAMPSA is the Refineria de Petroleos de Escombreras (REPESA), a company organized in 1949 by Caltex (Standard of California and The Texas Co.) Oil Products Co. owning 24 percent, CEPSA 24 percent, and CAMPSA itself owning the rest. REPESA owns a new refinery at Cartegena, on the Mediterranean coast, now producing slightly less than 7,000 b/d of gasoline. It now uses some 250,000 tons of crude annually.

To reduce its dollar drain, CAMPSA itself has also tried drilling some 30 locations, but has met with no luck. Most serious problem has been the lack of adequate drilling equipment. CAMPSA has but two rigs and the best can drill no deeper than 3,000 feet.

In 1949 the nearest thing to success was a well drilled at Villanueva de Campalay, some 50 miles from Santander, on the Bay of Biscay, where 300 barrels was pumped. Other locations have only resulted in "very promising shows."

CAMPSA has not given up. Its geologists, mostly Spanish, French and German trained, are now surveying extensive tracts near northeastern Burgos and renewed drilling will start there soon. CAMPSA has been delaying its drilling some, hoping that the Mutual Security Agency will sign the much publicized aid agreement with Spain. Should MSA and Spain get together, CAMPSA hopes to get sufficient dollars (under the economic aid section of the agreement) to buy a large United States rig and to start drilling in earnest. Meanwhile, though, it is preparing detailed surveys.

The only other company to drill in Spain has been Empresa Adaro, a subsidiary of the Instituto Nacional de Industria. Both the Instituto and CAMPSA are part of the Ministerio de Hacienda (Ministry of Finance) which, under engineer Felix de Gregorio, controls all activity in Spain. Adaro has drilled near southern Cadiz, but has only encountered some shows at 200 feet.

While many reports have circulated that United States companies would be interested in doing some large scale drilling in Spain, most are unfounded.

Main reason is that Spain has no special petroleum law, and the present mineral laws under which all oil activity is regulated do not offer sufficiently attractive conditions for most foreign companies to risk wildcatting.

Socony Vacuum's venture lasted only slightly more than a year, and Caltex, the only other United States company that has shown an interest in Spain, has concentrated only on the distribution end.

At present foreign firms may own only 24 percent of the stock in any firms operating in Spain. CAMPSA officials have told this correspondent that special exceptions would "very likely" be granted if American firms were to apply for them. However, CAMPSA spokesmen say no drilling discussions have been conducted for the past year.

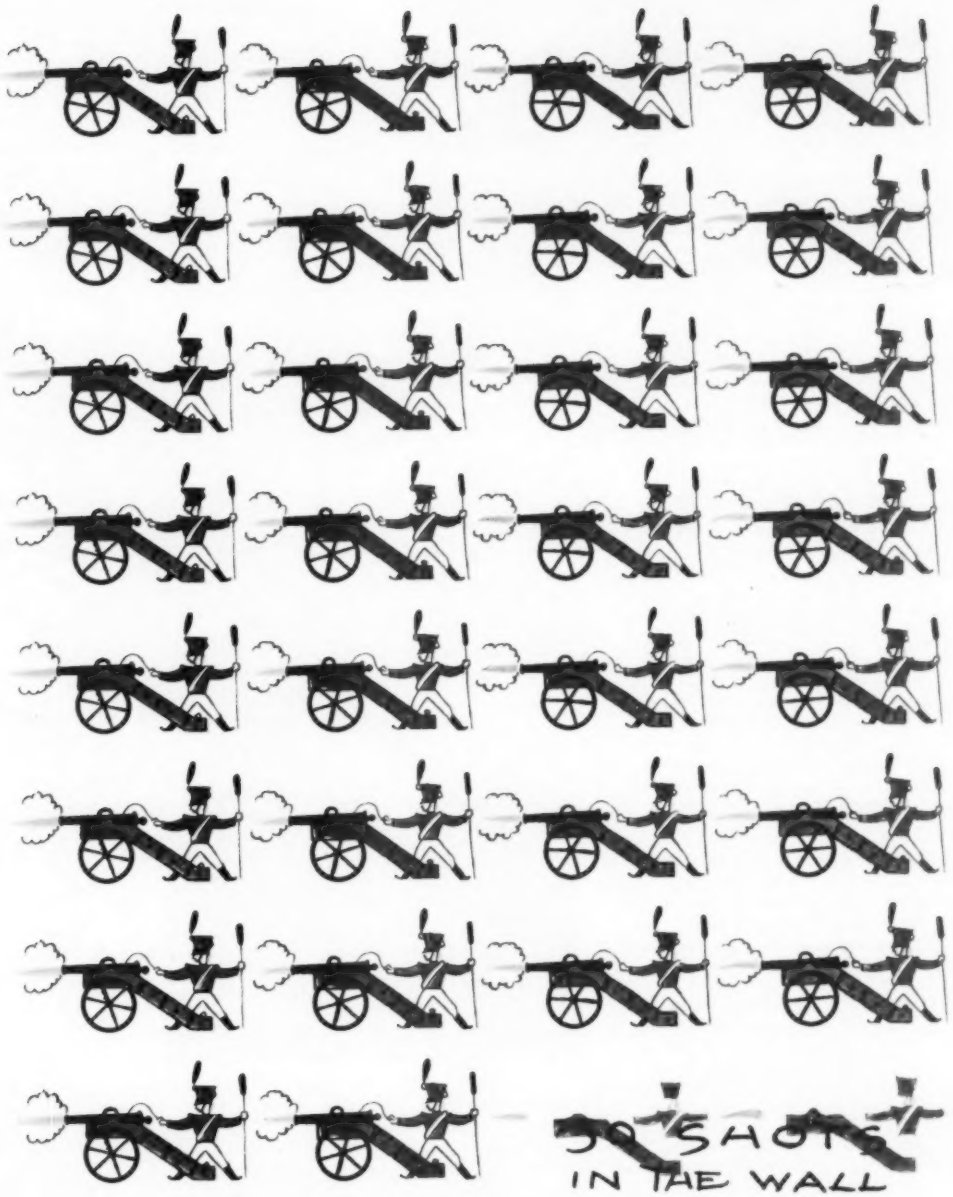
In a major step to reduce dollar expenditures, CAMPSA has been ambitiously building up a larger tanker fleet. It now has 19 ships with a total capacity of 175,000 tons. Under a program launched recently, capacity ought to be nearly doubled in about five to seven years, depending on the availability of steel and other construction material.

Two 10,000-ton sister tankers should be completed by early 1953, and three of 2,000 tons are now scheduled for completion in 1954.

In February bids were let for three 15,000-ton vessels which must be completed in four years. Other bids will soon be let in a step to eliminate all need for use of foreign tankers. In fact, when the building program is complete, Spain should have sufficient tankers to meet its own expected demand of 2,000,000 tons yearly and be able to hire out some of its vessels.

Besides the CAMPSA fleet, CEPSA has its own tankers capable of carrying more than 60,000 tons. It is also planning an increase shortly.

Thus, while Spain ambitiously steps up its search for oil, it realizes well that the chances are slim. That fact is making it turn to solving its main worry now, the reduction of dollar expenditures. It believes that success will depend upon more local refinery capacity and an increased tanker fleet.



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GENERAL ELECTRIC

BRAZIL STILL DEBATING OIL BILL

By R. G. WALKER

ALTHOUGH the leader of the majority party in the Chamber of Deputies stated in December that the government's oil bill should reach the Senate in mid-March, it had not yet come up for plenary debate in the Lower House at the beginning of May. The various House Committees are still discussing and suggesting amendments. The principal political parties, on the other hand, are gradually defining their attitudes.

The National Democratic Union, the most numerous opposition group, declared in favor of a state monopoly, thereby siding with the Nationalists. The latter, although perhaps not numerically strong, are energetic opponents of private enterprise. The majority party, the Social Democrats, approves the bill in principle, but proposes minor amendments. The Republicans, under ex-president Arturo Bernardes, a staunch Nationalist, are sharply divided. So, also, is the President's own group, the Labor party, and one of its prominent members has drawn up a substitute bill, which has attracted a few adherents.

The substitute stipulates that the capital of "Petroleo Brasileiro," which is to control all oil activities, shall be made up of at least 51 percent of shares held by the Federal Union, the remainder to belong to the states and municipalities, who may transfer their holdings only to the Union. The sole possibility of private capital participating is provided in an article reading: "The distribution and commerce of petroleum products produced, or merely industrialized, in the country, or imported by the Society (Petroleo Brasileiro), may be carried out by subsidiary enterprises, expressly organized for the purpose." But 51 percent of the capital of these enterprises must be subscribed by "Petroleo Brasileiro" and the remainder by native-born Brazilians, or by companies legally organized so as to preclude the formation of monopolistic groups, either foreign or national. Existing companies may continue to function in their present situation, operating with derived products imported by them. The capital of "Petroleo Brasileiro" would be made up of the refineries and tankers owned by the Union, by a surcharge of 40 centavos on the sole tax on each litre of gasoline during ten years, by the dividends on the Society's shares, and by any sum which, by virtue of a legal or contractual provision, is destined for oil prospecting and exploiting and correlated activities.

Although the leaders of the principal parties have agreed on the attitude to be assumed, the remaining deputies and senators in each group are by no means unanimous and may diverge in the voting. A few agree with the Nationalists that the bill, if approved, will eventually lead to domination of the oil industry by foreign interests. In reply to this argument, those who approve the project point out that 51 percent of the shares in "Petroleo Brasileiro" would be held by the Union and that technical control would be reserved exclusively to Brazilians. Many argue that a state monopoly would be preferable if Brazil could muster the financial resources necessary to develop the industry within a reasonable time. Those who advocate greater liberality, in order to ensure financial assistance from abroad, point out that no foreign company will be likely to participate unless it has a voice in the technical direction of the Society.

Another objection to the bill concerns the method of obtaining funds and the large amount which is to be collected. These criticisms are answered by Dr. Pedro Moura, of the National Petroleum Council, and by Sr. Romulo Almeida, the President's personal assistant, both of whom assisted in preparing the project. The former estimates that, in accordance with his calculations, an absolute minimum of 3,100 million cruzeiros (U. S. $160,500,000) would be required in the four years 1952-55. This sum would be needed in increasing yearly amounts, namely 350, 650, 900, and 1,200 million cruzeiros. At the same rate of increase, 1,600 million cruzeiros would be required in 1956, making 4,700 million in all, which is very near the total of 5,000 million proposed in the President's message.

Sr. Romulo Almeida, emphasizing the urgency of a solution, told the press that the country actually consumes products corresponding to more than 140,000 barrels of oil daily. In 1956 consumption may be expected to reach 250,000 and Brazil's capacity to import will not be equal to such a demand. Difficulty is already experienced this year, he said, when U. S. $266 million must be found to pay for liquid fuels. In 1955 or 1956 U. S. $330 million will be needed to import crude only, and U. S. $495 million to continue imports of refined products. Brazil's requirements of liquid fuels will not diminish. The population is growing rapidly, road traffic is expanding, and the number of motor vehicles in service increased by 20 percent between 1950 and 1951. Railways and ships are resorting more and more to the use of liquid fuel and commercial aviation is developing at a spectacular rate.

As regards aviation, Air Brigadier Nero Moura, Minister of Aeronautics, stated recently that in 1951 Brazilian commercial aircraft flew 37 percent more miles than in 1950, opened up 53 new inland routes serving 26 additional towns, and began operating eight more international lines. Consumption of aviation gasoline is expected to increase 90 percent within the next five years to meet the growing needs of national and foreign commercial carriers and the Brazilian Air Force. The solution of the oil problem has become extremely urgent in the interests of progress and safety. Even if foreign suppliers can continue to fill Brazil's needs without interruption, the country will be unable to command the immense amount of exchange necessary to pay for imports on such a scale.

During 1951 Brazil imported 1,976,067 tons of gasoline, 2,790,264 tons of fuel and diesel oils, 183,431 tons of refined lubricating oils and 281,356 tons of kerosine. These figures represent increases of 358,059; 441,577; 67,905 and 68,711 tons, respectively, when compared with those of 1950.

General Anapio Gomes, director of the credit department of the Bank of Brazil, in urging an immediate solution of the oil problem, recommends drawing up a work program without delay and starting negotiations with the United States government in order to obtain the equipment and technical assistance Brazil requires. If the United States cannot meet the needs with the necessary urgency, Brazil should approach any other government able and willing to assist. General Gomes concluded: "The critics of the government's oil bill are mistaken when they suggest that Brazil has adequate financial resources to solve this problem. They forget that the collossal sums to be expended abroad for equipment, use of patents, and contracts with specialists represent foreign exchange and must be provided by exports. Those with any knowledge of Brazil's balance of payments have no illusions on this subject. We do not possess, nor do I know when we are likely to possess, exchange to cover such an expenditure."

At a recent "round table" of the Federation of Brazilian Commercial Associations convened to discuss the oil bill, all delegates, except those of Minas Geraes, declared in favor of the participation of private enterprise in the petroleum industry, parallel with those formed with mixed state and private capital. They also recommended that prospecting activities should not be reserved exclusively to the state.

Much of the confusion surrounding the government's project is attributed to the fact that President Vargas has made no attempt to guide the discussions or hasten

(Please turn to next page)

O. W. Morgan

Morgan Joins Oil Well Mfg. Co.

Clarence White, president of Oil Well Manufacturing Corp. has announced the appointment of O. W. Morgan as general sales manager for Red Devil products. Mr. Morgan is well and widely known in the oil industry, having served 15 years with Bryon Jackson Co. He is a member of Nomads, a charter member of the Petroleum Production Pioneers, and a member of API. He majored in engineering at Stanford University.

In his new position he will be assisted by Carroll Baker at the home office and by salesmen and representatives with warehouse stocks at various points in the oil fields.

Orbit Valve Sales Transfers

Orbit Valve Co. of Tulsa has made a number of changes and additions to its field sales staff according to R. G. Cole, general sales manager. Jack H. Hancock is being transferred to Casper, Wyo. as field representative in the Rocky Mountain area from Chickasha, Okla. He will be succeeded there by Claude W. Brown, who is moving from Great Bend, Kans. James P. Bowling has been named city salesman for Houston, Texas. In the Rocky Mountain area and Canada, LeRoy Mitchell will continue as distributor and maintain Orbit's stock at Casper.

Barchard Heads New Meter Division

J. W. Ostler, manager of Canadian Meter Co., Ltd., Hamilton, Ont., the "Maple Leaf Division" of American Meter Co., has announced that Barchard Engineering and Equipment of Edmonton, Alberta, which has represented the company in the oil industry in Western Canada since 1949, will now be operating as the western division of Canadian Meter Co., Ltd., at the same headquarters. F. M. Barchard is manager of the new division, which will operate in British Columbia, Alberta, Saskatchewan and Manitoba.

F. M. Barchard

Completes World Tour

Oil companies in the Far East are making definite progress despite tremendous operating difficulties, says John B. O'Connor, executive vice-president of Dresser Industries, who has just returned from a nine week, 28,000-mile round-the-world tour. "In Burma, Malaya, and Indonesia, however, it looks as if it might be quite some time before operations can be carried on with any real degree of safety," he reported.

Mr. O'Connor noted a tremendous increase in the consumption of petroleum products in Asia and the drive to substitute petroleum for other fuel.

In Hong Kong, natives used to shuffle along with their little bundles of wood, their fish or vegetables; now a bottle of kerosine replaces the wood in most instances. Part of this transformation is the result of the oil companies' promotion showing that three cents worth of kerosine does the work of twelve cents worth of wood.

"Recovery was particularly apparent in Germany and Japan," Mr. O'Connor said. "People in these countries are working hard and show a real degree of progress."

Mr. O'Connor expressed a feeling of grave concern for the general unrest noted in his travels, but was impressed with the petroleum industry's dogged and constant progress even in remote regions of the world.

Mr. and Mrs. J. B. O'Connor

Book Review

The Performance of Lubricating Oils, by H. H. Zuidema (Shell Oil Co., Wood River, Ill.), an American Chemical Society Monograph, published 1952 by Reinhold Publishing Corp., New York; 179 pages; $5.00.

In this book the subject is approached, not from the point of view of application of specific products (airplane oils, automobile oils, etc.), but rather from the standpoint of performance (oxidation, resistance to corrosion, flow characteristics, sludge and lacquer deposition, emulsification foaming, viscosity, pour point, extreme pressure lubrication and other fundamental traits common to all lubricants in general). Consideration is given to the effect of manufacturing methods on performance characteristics of the final products. There is a chapter on synthetic lubricants and a section on the reaction kinetics involved in lubrication problems.

Book Review

History and Development of Ferrolum Lead-Clad Steel and Cupralum Lead-Clad Copper, by Alfred P. Knapp; published by Knapp Mills, Inc., New York.

This is a 22-page booklet describing the new lead-clad copper and steel products that are becoming of large importance in many industries which have to deal with sulfuric acid, hydrochloric acid, and other corrosive fluids. Many forms and uses of these materials are described.

Brazil Still Debating Oil Bill

(Continued from previous page)

the passage of the bill through Congress. Both he and his immediate predecessor, General Dutra, have departed from the Brazilian tradition, according to which the President makes his wishes known and Congress carries them out. The first indication of the President's opinion regarding the bill was conveyed to the Lower Chamber early in May in a vague statement by the leader of the majority to the effect that "Dr. Vargas favors the creation of a 'mixed society' to exploit Brazil's oil reserves."

At the moment, the confusion is such that responsible Brazilians hesitate to express an opinion as to when, or in what form, the bill will reach the statute book.

The president of the National Petroleum Council told Congress recently that the financial resources at his disposal this year amount to the equivalent of U. S. $17,600,000. Of this sum, U. S. $7,865,000 will be expended in the initial phases of prospecting and exploitation. The greater part of the balance will be absorbed by the purchase and maintenance of tankers.

The Council has drawn up an extensive program of work in the Amazon Basin and hopes to start drilling there this year. Operations during 1951 extended from the Lower and the Middle Amazon and embraced Marajo Island, the State of Para, in the Cametá, Santarem and Obidos regions, north and south of the Amazon River, and the State of Amazonas, along the Madeira and Purus Rivers. Preliminary studies are now being carried out in the Acre territory, within 60 miles of the Peruvian Orient oil zone, where prospecting and drilling operations had to be abandoned some years ago.

In Sao Paulo, in addition to the pioneer well at Angatuba, where a rig is now being mounted, sites have been selected for five other wells. Colonel Gabriel Fonseca, president of the Commission for the Industrialization of Bituminous Schists, states that investigations in the Taubate region, based on numerous drillings and analyses, indicate the existence of a potential volume of 2,000 millon barrels in an area of 200 square kilometers.

The transformation of the Companhia Ypiranga's skimming plant in Rio Grande do Sul, including the installation of a cracking unit and the doubling of output, will cost U. S. $4,400,000. The new installations, with capacity for 5,000 barrels daily, should begin operating towards the end of 1952.

A group of Amazon capitalists has applied for a concession to build a 2,500 barrel refinery at Manaos, to work with Peruvian oil. The application has been favorably received by the Petroleum Council and passed to President Vargas for his decision.

The residual gases of the Cubatao refinery are to be utilized to make nitrogenous fertilizers. A factory will be built adjoining the refinery and the equipment will be supplied by German firms. To guarantee payment, the Brazilian Sugar Institute will ship 250,000 bags of sugar to Germany during 1952. Another project, recently approved, provides for the extraction of sulfur directly from the pyritic rejects of Santa Catarina coal. These are estimated at 322,000 tons annually, with 26.23 percent sulfur and 16 percent carbon, and are expected to yield 84,700 tons of sulfur.

New Western Gear Booklets

Two new booklets have been published by Western Gear Works, Lynwood, Calif. One deals with Pacific Western torque converters and the other with gear drives for pipe line service. The torque converter booklet gives general specifications of the line and detail drawings with charts showing performance characteristics. Gear drives for either high speed or low speed pumping are illustrated in Bulletin 5204 which describes drives with capacities up to 1,700 hp. Copies of both booklets are available on request.

Better Instrumentation
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▶ MODERN TECHNIQUES
Result in...
the discovery of geological formations favorable for the accumulation of oil.

British Equipment Industry Records Steady Progress

By E. Lawson Lomax

The classified list of petroleum equipment manufactured for export in the U.K. during 1951 has recently been released, for the first time being merged into the total equipment manufactured for home use and export reaching the large amount of £83,991,440 ($237,695,662), split up into various categories as follows:

VALUE OF ORDERS PLACED IN THE UNITED KINGDOM BY OIL COMPANIES DURING 1951 FOR MATERIALS AND EQUIPMENT

Geophysical and other exploratory equipment, etc.	$ 71,882
Specialized equipment for oil drilling and production, including oil casing, tubing and drill pipe, etc.	26,083,633
Specialized equipment for oil refineries, etc. (not including pumps and valves).	8,211,245
Drum and can making, filling and cleaning equipment, curbside pumps and other oil metering and dispensing equipment, etc.	4,080,577
Railcars, road tankers, aircraft refuelers, etc.	941,541
Drums, drumsheets and tinplate	22,444,164
Tankage (including tank fittings)	15,378,786
Tubulars, pipe fittings and valves (ferrous and non-ferrous)	45,436,782
Pumps (excluding slush, oilwell and curbside)	3,605,420
Boilers, boiler house plant and accessories, etc.	1,585,932
Electrical equipment—motors, generators, transformers, etc.	12,082,119
Instruments, meters, gauges, etc.	2,254,944
Prime movers and compressors	4,557,149
Machine and hand tools, welding and miscellaneous machinery and stores	16,884,063
Ferrous and non-ferrous plates, sections, sheets and bars	8,464,530
Automotive equipment, all types	17,333,467
Laboratory equipment and chemicals including hospital and medical supplies	1,260,765
Bulk chemicals, catalysts, barites, etc.	23,219,867
Cement and other building materials and hardware, including timber	12,115,513
Commissary, general requisites for office, warehouse, household, club and sports, etc.	11,603,283
	$237,695,662

Of this amount it is estimated that about £56-57 million ($158-$161 million) was the value of material ordered for export.

When it is remembered that the comparative figure pre-war was about £9 million ($25 million), it will be seen what vast strides the industry has made in recent years, while at the same time there is no indication, provided raw materials, such as steel, etc. are available, that these figures will not be exceeded in future years, the figures for the first period of 1952 being £22,468,100 ($63,584,723).

This, however, does not include the ancillary equipment manufactured in the form of tankers and their fittings, an industry in which Britain plays a major part.

As an indication of the large sums involved in these activities, the case of shipbuilding alone is of interest.

At the end of 1951, the total number of oil tankers building or on order in the shipyards of the world, apart from the USSR, was 515, with a total deadweight tonnage of 10,577,000. Out of this number 234, with an approximate deadweight tonnage of 4,672,000, were on order or under construction in British shipyards, of which 1,666,000 dwt was for export. At the present building cost of £50 per dwt, these orders for export amount to over £83,000,000 ($235,000,000).

These figures are also an advance on the figures for 1950, showing an all-around advance in British construction for export for the petroleum industry.

Although the main refinery construction in Britain is nearing completion and a reduction in the manufacture of equipment for the home market may therefore be expected in the coming years, yet that reduction probably will be well balanced by the British petroleum companies' program for the erection of refineries in other parts of the world, some of which are in course of designing.

The work of CBMPE has undoubtedly played a great part in assisting the development of the manufacture of petroleum equipment in the United Kingdom, and the council is continually extending its activities in this direction, such as a move for the provision of British equipment for use in universities for the training of engineering and technical students. A mission consisting of members of the Council has visited the United States to study the oil industry, and the work on standardization has been actively pursued. A large number of new standards have been published by the BSI which in the main are comparable with the standards of API.

These deal mainly with steels for use in the chemical, petroleum and allied industries; pipes, both ferrous and nonferrous, for all sections of the industry; gate and plug valves for refinery use; butt and socket welding fittings; carbon and alloy steels for condensers, coolers and heat exchangers; welded wrought steel pipes for ordinary service up to over 30", and for high temperature service from 18" and over.

Other standardization which is in course of preparation deals with flange steel valves of all types, bronze and gun metal valves, drop forged steel fittings, screwed API line pipe threads, union fittings, screwed socket weldings, flanged and "quick change" couplings, instrument tubing, compressed asbestos fiber jointings, curbside pump hose, seamless alloy steel furnace tubes, domestic appliances for kerosine burning, bolting material of all kinds for the industry, domestic appliances for LPG, storage tanks (both vertical and horizontal with dished ends), pressure piping code, gas masks, and respirators and breathing apparatus.

In connection with other bodies, standard specifications are being studied for steel castings, for surface hardening, refractories, thermal insulating materials, corrosion prevention of machined parts, and anti-pest packaging.

It is, however, only in the question of auxiliary parts, although of great importance in other manufacture, that standardization can be of primary advantage to an industry such as that of petroleum. It faces ever-changing conditions of activity from primary exploration in different types of territory, through the exploitation of drilling, involving at all stages changing techniques and equipment, and still further in the rapid development of methods of refining to produce the class and quality of products required by alterations in market demands.

The shortage of steel due to re-armament demands is an ever-present menace, the full effect of which has not yet been experienced, but manufacturers and contractors are already striving to overcome this possibility by the development of methods for the use of alternate materials.

The healthy state of the industry, both mentally and physically, holds out bright prospects for its continued prosperity, and for its ability to meet any future demands made on it.

SAFETY GOGGLES

Recent introduction of "Armorglas" toughened lenses for safety goggles made by J. & R. Fleming, Ltd., London is of importance in many industrial operations.

The photograph shows the difference in performance of this glass compared with other glasses when a steel ball ⅞" in diameter and weighing 54 grams is dropped on it from a height of 54".

Fig. A. Ordinary glass shattered by one blow from 50".

Fig. B. Laminated glass after one drop from 50".

Fig. C. "Armorglas" after 100 blows dropped from 50"-72".

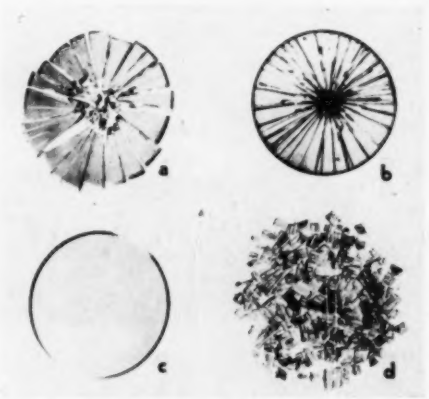
Fig. D. "Armorglas" lenses broken into pieces showing cubical shapes into which it fractures.

PORTABLE VISCOMETER

A portable viscometer developed by Ferranti, Ltd., Hollinwood, Lancashire, provides an accurate means of rapidly measuring viscosities of liquids in centipoises, both in the finished state and in course of manufacture.

It consists of a rotating outer cylinder driven by a small motor with a second cylinder located co-axially within it. The inner cylinder is free to rotate against a calibrated spring with a pointer to show the angular deflection.

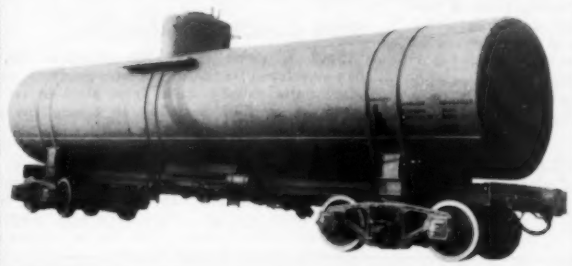
To measure the viscosity of a liquid, the cylinders are simply immersed in it, the motor is switched on and the viscosity is read on the calibrated dial at the top of the instrument. Viscosity ranges from 0-300,000 poises are covered by standard models. There is a quick release mechanism for cleaning of the parts after immersion. Operation is from normal AC mains of 200-250 volts, 50 cycles.



Safety goggle performance comparison.

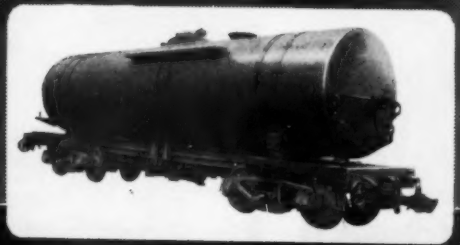
Ferranti portable viscometer.

HURST NELSON TANK CARS



We design and build Tank Cars to meet variations in the factors of volatility, viscosity and all other properties of the liquids to be transported; we fit them also to suit all types of terminal loading and discharging facilities at installations. Our service can meet your precise requirements.

We invite your Enquiries



HURST NELSON & Co LTD

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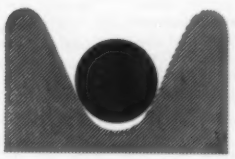
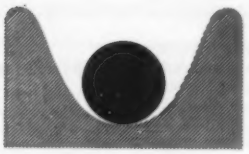
"Stop pinching me, you pulley!"

You can't punish ropes **and** expect to get the best out of them. So watch your PULLEYS and SHEAVES.

The radius of the groove of a pulley should always be slightly larger than that of the rope passing over it. If the groove is too narrow, it will crush the rope and soon damage the wires.



WRONG
Pulley groove too narrow.



WRONG
Pulley groove too wide.

RIGHT
Pulley groove correct—supporting the rope for 1/3rd. of its circumference.

If too wide, the rope not only wears more quickly at the point of contact but also cuts a false groove in the pulley.

With sheaves, oil the bearings at frequent intervals and check that they rotate freely. A seized up sheave can ruin a rope very quickly. Watch alignment too; see that sheaves, drums and pulleys are set exactly in line with the rope that is working over them.

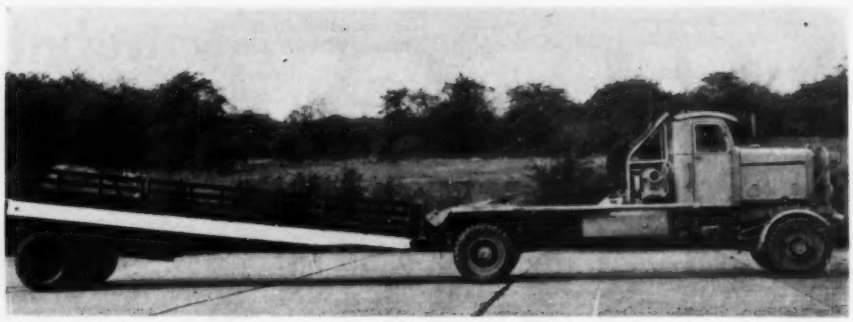
Pin up this announcement where your staff can see it.
It is issued in the interests of longer rope life by

British Ropes Limited

HEAD OFFICE: DONCASTER

EXPORT SALES OFFICE: 52 HIGH HOLBARN, LONDON, W.C.1

Thornycroft self-loading truck.



Hands self-loading semi-trailer.

SELF-LOADING TRUCK

John I. Thornycroft & Co. Ltd. has developed a self-loading arrangement for its "Mighty Antar" 25-ton oil field truck, by which the loading or unloading of a unitized load can be carried out in a matter of a few minutes by the driver and his assistant, unaided and without the use of auxiliary tools or other equipment.

The chassis is a "Mighty Antar" six-wheeler of 21′ (mean) wheelbase, equipped with rear bogie beams in place of springs. A power take-off of 100 bhp on the auxiliary gear box drives a "Tulsa 70" 50,000-lb. pull winch mounted behind the driver's cab. The all steel platform body, to the design and construction of R. A. Dyson & Co., Ltd., incorporates among other features an extra heavy duty tail roller.

ALL-METAL FLEXIBLE COUPLINGS

A new coupling which eliminates the inherent disadvantages of many flexible couplings for medium and high speed drives has been developed by Metaducts, Ltd., which is of particular interest to the petroleum industry where such drives are employed in many cases where it is difficult to provide stable foundations.

The advantages claimed for this new coupling are: all metal construction; flexible membranes of stainless steel, monel or phosphor bronze; couplings unaffected by climate or operating temperatures or conditions; coupling permits angular misalignment between driving and driven units, yet at the same time ensures a positive drive under all conditions of load.

The drive is through flexible membranes which permit adequate axial movement between driving and driven units. The resistance to axial movement is controlled by the number of flexible membranes which can be varied to meet individual circumstances, but in all instances resistance to movement is so low that it can be considered negligible. Two "Metastream" couplings used in conjunction with a jackshaft or a Metastream Spacer coupling will permit not only angular displacement, but also lateral displacement between driver and driven units. Balance is assured under all conditions of loading, whether in alignment or otherwise, and without any form of lubrication.

OIL FLOW—AIR FLOW COMBUSTION GUIDE

An instrument has been developed by Bailey Meters & Controls, Ltd., Moorgate, London, to assist the operator in maintaining correct fuel-air ratio and provide optimum combustion conditions.

Two clear chart records, oil in red and air in blue, enable the operator to see at a glance that such ratios exist and that the correct value of excess air is being maintained.

On installation the meter is adjusted on the basis of combustion tests and observation of furnace conditions so that for optimum combustion efficiency it is only necessary to keep the red oil flow pen and the blue air pen coincident.

The oil meter is of the bellows type employing the Bailey system of electronic transmission band on an AC bridge zero balance potentiometer principle.

The air flow mechanism in the oil flow receiver-recorder incorporates a differential diaphragm connected either across the gas passes or to the air fan. An integrator showing total flow of oil can also be fitted.

LIFTING GEAR

Industrial Truck Development, Ltd. of Ladbrooke Grove, London, has developed fork lift equipment having load capacities of from 1,000 to 5,000 lbs. and lifting heights of from 6′ to 14′ on a chassis powered with diesel, gasoline and battery electric units.

Stacatruc diesel-engined fork lift truck model 2 DH/9 fitted with flash proofing equipment is specially adapted to the petroleum industry for use in areas where it is important to combat a specific fire hazard by fitting special devices to the air intake and exhaust outlet, and eliminates the use of electrical means for starting by substituting an air-operated starter motor.

Matthew Brothers of Wallington, Surrey has developed a fork lift truck for use in overseas oilfields, equipped with giant pneumatic tires (single or double) suitable for soft ground, and powered with 36 hp 4-cylinder Ford gasoline engines or 44 hp 6-cylinder Perkins diesel engines.

SELF-LOADING SEMI TRAILER

Hands (Letchworth) Ltd. has developed a self-loading semi trailer, in conjunction with the long wheelbase "go anywhere" Scammelldrive and power winch. The combination is a joint undertaking between Scammell Lorries, Ltd. of Watford, which provides the tractor chassis, and Hands-England Oilfields Equipment, Ltd., which equips the tractor with the steel body, fifth wheel and gin poles. The chassis can also be used as a load carrier in its own right by using a steel deck as a normal rigid vehicle.

SPUN CONCRETE PRODUCTS

Spun Concrete, Ltd., Rye Harbour, Sussex, has developed various concrete products to replace units usually made from steel in refinery construction, thus assisting in easing the steel shortage situation.

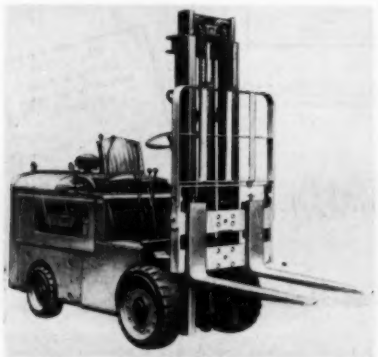
In the case of flood-lighting masts and lighting columns, the barrel is manufactured by the centrifugal spinning process with bases cast on of vibrated concrete. In addition a large number of spun concrete pipes have been made for drainage in the various refineries now under construction in the United Kingdom.

HEAVY DUTY GEARS

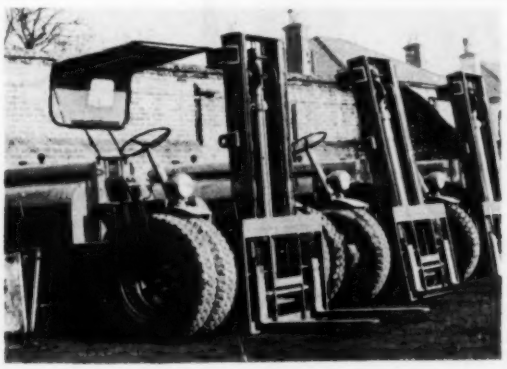
The David Brown Companies, Ltd., Meltham, Yorkshire, the largest gear-making organization in the British Commonwealth, announces that it is now producing heavy duty spiral bevel gears for drilling plant as well as power transmission machinery for all types of oilfield and refinery equipment. A modern heat treatment plant electrically operated with automatic control enables these products to be treated while maintaining the advantages of initial accurate manufacture.

HEAVY TRACK TRACTOR

During the past 12 months pre-production models of Britain's first heavy track tractor, The Vickers V.R. 180, and its supercharged "Rolls Royce" 6-cylinder oil engine have proved themselves in exhaustive tests in the field and are now ready for production.



IDT model 2 DH fork lift.



Matthew Brothers fork lift trucks.

Vickers V.R. 180 heavy track tractor.

BOOKS

FIELD GEOLOGY—Frederick H. Lahee	$ 7.50
FUNDAMENTALS OF THE PETROLEUM INDUSTRY—Dorsey Hager	$ 6.00
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GAS ENGINEERS' HANDBOOK—Gas Engrs. Handbook Committee	$12.00
HANDBOOK BUTANE PROPANE GASES—Butane Propane News	$ 7.50
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OUR OIL RESOURCES—L. M. Fanning	$ 6.00
PETROLEUM GEOLOGY—R. M. Landes	$10.00
POLYMERIZATION OF ACETYLENE—Karl Kameyer	$17.50
PETROLEUM REGISTER (International Petroleum Register) 29th Edition, 1951-52	$15.00

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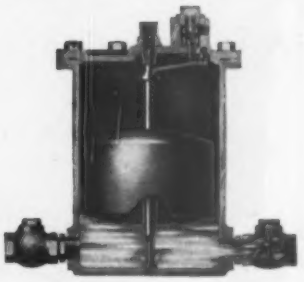
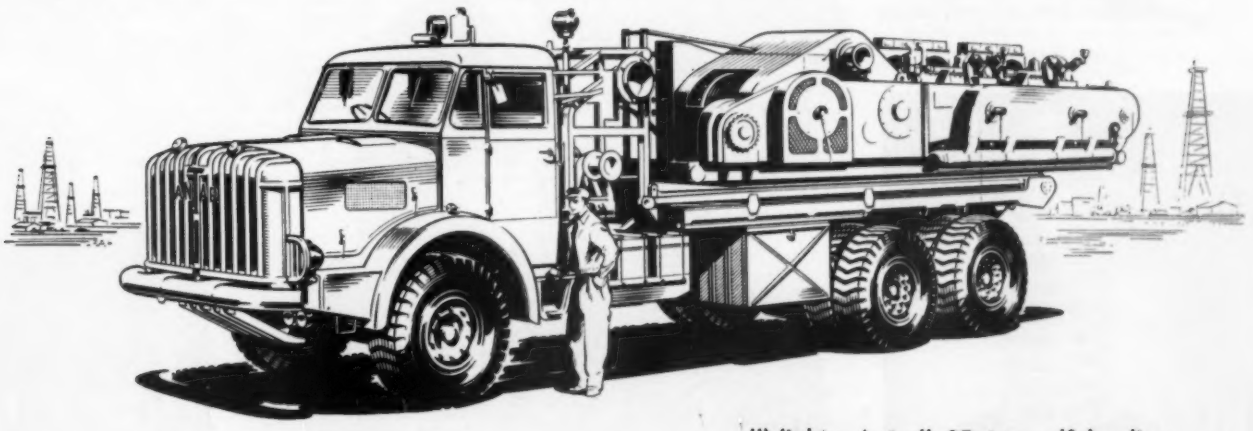
Lifting oils and liquids with this AUTOMATIC PUMP



This automatic pump combines the good qualities of a pressure pump and a vacuum trap. Pumps hot condensate from low-pressure or vacuum vessels and lifts up to fifty feet or more; pumps boiling, cold or gaseous fluids (including oils); pumps petrol, benzine, dye liquors and alkaline liquors such as caustic, ammonia, etc.; drains sump holes, pits, excavations (where it may be fully submerged). Stops when there is no more liquid to pump; restarts automatically when liquid again flows into it. *Details of the 'Ogden' Pump (in five sizes) from:* SPIRAX MANUFACTURING CO. LTD., (Petroleum Dept.) Charlton House, Cheltenham, Eng.

THORNYCROFT

SPECIALIST SUPPLIERS OF WHEELED TRANSPORT TO THE OIL INDUSTRY

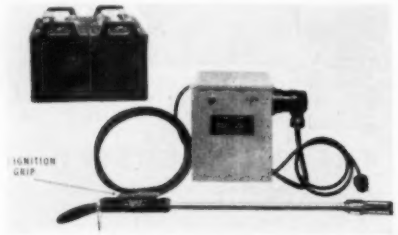


"Mighty Antar" 25 ton self loading oilfield truck. One of several shipped to Sarawak and Venezuela for Shell.

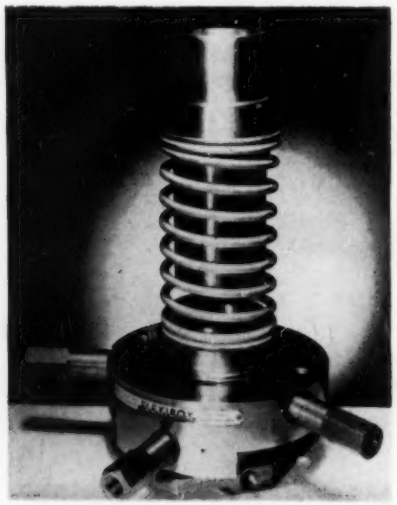
JOHN I. THORNYCROFT & CO., LIMITED, THORNYCROFT HOUSE, SMITH SQUARE, LONDON S.W.I., ENGLAND.

Quasi-Arc welding transformer.

Rego automatic throwover manifold.



Wallsend low voltage ignition torch.



Flexibox seal for jet aircraft pumps.

SINGLE OPERATION WELDING TRANSFORMER

The Quasi-Arc Co. Ltd., Bilston, Staffs., announces that a new single-operation welding transformer is now available in its range of AC transformer welding equipment. The plant is oil cooled, and has a current range of 50/450 amps. The exclusive Quasi-Arc current selector roller switches give 79 current settings within this range, and welding output can be obtained at either 80 or 100 open circuit voltages.

The trend in welding fabrication for some years has been toward the use of heavier electrodes, and this 450-amp. welding transformer enables electrodes up to 5/16" in diameter to be deposited speedily and economically.

A feature of the plant of particular interest in overseas countries is that there are 24 input voltage tappings provided so that the plant can be connected to power supplies ranging from 175/550 volts.

LPG EQUIPMENT

LPG Equipment, Ltd., Birmingham, a subsidiary of Wright, Burdley & Gell, Ltd., is now producing liquid petroleum gas equipment under license from the Bastian Blessing Co. of Chicago. Among the outfits made is the Rego No. 2523 automatic throwover manifold, complete with indicating gauge, No. 2403 regulator and two pigtails. This is especially intended for use where increased gas loads and the demand for uninterrupted service prevail. The unit functions automatically in supplying fuel from the reserve side of the system after the cylinder (or bank of cylinders) on the service side is exhausted or if the pressure drops too low because of heavy fuel withdrawal.

LOW VOLTAGE IGNITION TORCH

Wallsend Slipway & Engineering Co. has developed an electric ignition torch which operates on a circuit of 12-14 volts. This equipment reduces the risk of fire in the boiler room, as it eliminates the use of paraffin, and with the low voltage there is no danger of shock from electric current.

The operating switch is combined in the grip handle, so that when the torch is laid down the current is automatically switched off. The torch has been successfully used on gas turbines, industrial furnaces and all types of boilers.

SEAL FOR JET AIRCRAFT PUMPS

Flexibox, Ltd., Manchester, has developed a special type of Flexibox seal for use in the rotary pumps of the latest British jet aircraft, which has been recognized by the AID.

In addition, a new flatness testing instrument has been recently put into use by the company for checking the precision lapping of component parts. This instrument is able to detect surface irregularities of the order of the wave length of light, i.e., about 22 millionths of an inch.

MAGNETIC OXYGEN RECORDER

George Kent, Ltd. of London & Luton announces the development of a new paramagnetic continuous oxygen recorder for use in industrial processes.

The design of the primary element of the recorder (the analyser) is based on the so-called "magnetic wind" principle, owing its efficiency to the fact that, of the common gases, only oxygen and nitric oxide are attracted by a magnetic field, oxygen more than twice as strongly as nitric oxide.

The gas to be analyzed is passed through a primary refractory filter inserted at a suitable point in one of the gas passes. It is induced through the filter by a water-operated aspirator fitted in the oxygen analyzer. The sample gases are carried through pipes to a measuring cell, an annulus with a horizontal glass by-pass tube. This by-pass tube carries on the outside two identical, adjacent platinum windings which are joined to a Wheatstone bridge current and become heated when a voltage is applied across the bridge. One of the windings only is traversed by an intense magnetic field from a large permanent magnet.

When the gas sample enters the measuring cell, oxygen is attracted into the by-pass by the magnetic field. As it becomes heated, it loses its magnetic susceptibility, is displaced by cool gas, and passes along the by-pass into the annulus. This continuous gas flow, or "magnetic wind," causes differential cooling, and thus differing electrical resistance, in the two windings on the by-pass, unbalancing the bridge. The resulting out-of-balance e.m.f. is measured by a standard Kent "Multelec" potentiometric recorder and is proportional to the oxygen content of the sample.

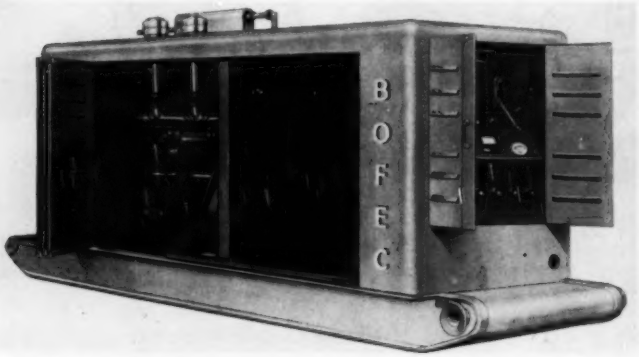
RIG LIGHTING SET

A new rig lighting set in course of production by British Oilfields Equipment Co., Ltd., London, can be supplied under the following ratings:

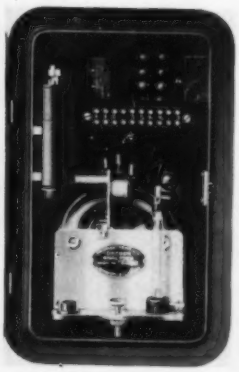
Type	RPM	Engine BMP	KW	Alternator Voltage	Frequency
RLS 6/60	1500	82	55	400/240	50
RLS 6/48	1200	68	45	230/133	60
RLS 4/40	1500	54	34	400/240	50
RLS 4/33	1200	45	30	230/133	60

These ratings are those being used continuously under operating conditions in the oilfields. The switchgear consists of an ammeter, voltmeter, ammeter "three phase" and "off" change-over-switch, carbon pile AVR, field regulator and tachometer. Each item is separately mounted on a shock absorbing cushion, and the whole switchboard is assembled on "Metalastick" anti-shock pads. Special features include sliding and hinged doors which open to expose the complete assembly for maintenance purposes.

Designed by Oilfield Engineers, the package unit is assembled on a skid and is protected against weather and tropical insect life by a lowered canopy.



BOFEC rig lighting set.



Kent oxygen analyzer.

BOOKS

PHYSICAL PRINCIPLES OF OIL PRODUCTION—Morris Muskat $15.00

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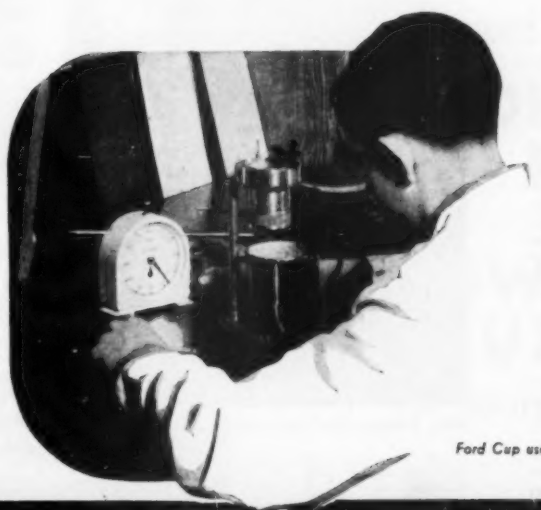
THERE'S MORE IN THIS THAN MEETS THE EYE



To the *average* man one brand of oil looks much like any other but the oil technician knows only too well the difference there is between a bad oil and a good oil. The best are those specially designed for the job they have to do. Research and technical control alone makes that possible.

Paints also may look alike but there is a world of difference between "paint" and the *right paint for the job*. All "International" products are the result of research and technical control—they are made for the job—YOUR JOB.

"TANCTECTOL" petrol-resistant paint for protecting interiors of storage tanks, is but one "International" product in wide use throughout the petroleum industry.

Ford Cup used for viscosity tests.

Registered Trade Mark

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GROSVENOR GARDENS HOUSE, GROSVENOR GARDENS, LONDON, S.W.1. Tel: VICtoria 3161 (10 lines)

ASSOCIATED COMPANIES AND AGENTS THROUGHOUT THE WORLD.

COMPRESSOR AND BREATHING APPARATUS

Siebe, Gorman & Co., Ltd., Tolworth, Surrey, has developed a 6-man compressor set and breathing apparatus unit for men engaged in cleaning oil tanks and plants. This unit can be used to supply fresh filtered air to any number of men up to six engaged in such operations, the quality and pressure of air being fully controlled.

Each mask is supplied with valves and a corrugated tube connected to a balancing bag carried on the wearer's back, together with a belt upon which is a fitting for connection to the supply tube, both the man's hands thus being left free to work.

ALUMINUM WELDING ELECTRODE

Murex Welding Processes, Ltd., Waltham Cross, Herts, has developed an aluminum 5 percent silicon electrode for the arc welding of aluminum alloys, the welds produced having a very high tensile stress, the minimum being 10.5 tons/sq. in.

It has been approved by the Ministry of Supply for the welding of military bridging equipment.

The larger gauge electrodes can be used with currents up to 400 amps. DC for deep penetration welding of aluminum alloy sections up to ⅝" thickness, without special edge preparation and without preheating, but thicker sections can be welded with suitable joint preparation. The electrode is smooth running and the slag easy to remove.

DIESEL ENGINE "PACKAGE"

Davey, Paxman & Co., Ltd., Colchester, have developed a diesel engine unit for oil drilling known as a "package" set, each unit comprising engine, water and cooling oil system, air intake filters, starting equipment, control gear, instrument panel, hydraulic coupling and cooler. The whole is enclosed in a steel canopy and mounted on a skid-type underbed, thus providing a compact and robust power unit which ensures maximum availability at site and allows for interchange of engines for servicing without affecting the compound drive to the draw works. The engines available as "package" sets cover a power range of 98-665 bhp, these ratings being taken at the output shaft. To assist in rapid changeover, the drive between the engine and corresponding gear is by internal gear coupling. Suitable devices are fitted for shutdown in case of reduction in lubricating oil pressure or rise in cooling water temperature and also for dealing with any natural gas struck while drilling.

GAS ENGINE DRIVEN COMPRESSORS

Alley & MacLellan, Glasgow, are now manufacturing Clark Bros. compressors under license in the United Kingdom. The accompanying photograph shows a 550 hp model HRA super two-cycle right angle unit made in Alley & MacLellan's works, ready for shipment to Assam. In addition, other two-cycle units have been made for service in Trinidad, Italy, England, and elsewhere.

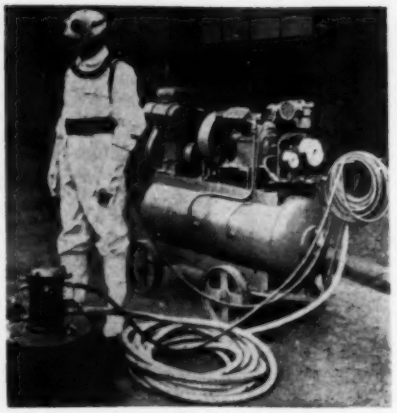
PNEUMATIC HOIST

The largest pneumatic hoist in the U. K. and possibly in the world has been supplied to Shell's Stanlow Refinery for use in maintenance work at the catalytic cracker.

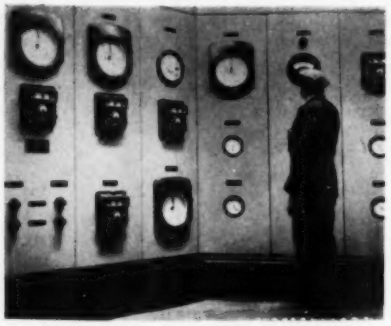
The working capacity of the hoist is 10 tons when operating on compressed air at 80-100 psi and the total height of lift is 60 feet. Power is supplied by a 5 hp radial type pneumatic motor, controlled by an opposed poppet valve which allows sensitive operation of the hoist.

The over-riding advantage of a pneumatic over other types of hoist in an oil refinery, where fire safety precautions are of the highest importance, is that it is completely flame proof.

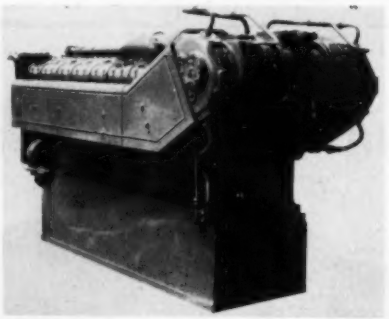
Air consumption of the machine when lifting at 100 psi is approximately 200 cubic feet of free air per minute.



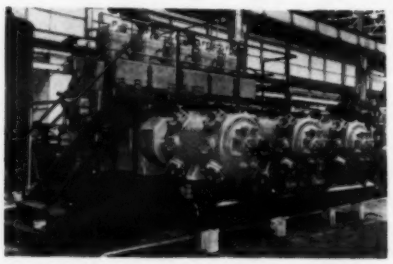
Siebe, Gorman compressor set.



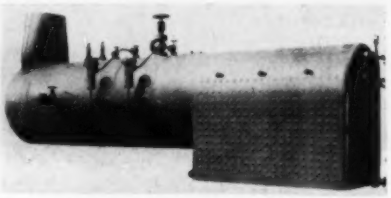
Eversheld & Vignoles process controls.



Davey, Paxman diesel engine "package."



Alley & MacLellan built compressor.



Ruston & Hornsby all-welded drilling boiler.

PROCESS CONTROL INSTRUMENTS

Eversheld & Vignoles, Ltd. of London has developed a new method of process control based on electronic operation of instruments as against pneumatic operation. The advantage of this method is that the response of the instruments is virtually instantaneous, irrespective of the distance between plant and control room, time lags due to the compressibility of air in pneumatic control lines being eliminated so that any deviation from specified quantities of flow, pressure or level is corrected instantaneously.

The main development is the Eversheld process controller, a three-term instrument having directly calibrated adjustments for proportional band, integral and derivative terms. The controller has an output of a few milliamperes DC and is used to position the standard diaphragm type of control valves. Connection between the plant and control room is by multi-core telephone cable, the electric signals between the instruments being in the form of a small continuous direct current. Flame proof practice is embodied and the apparatus is independent within wide limits of variation in supply voltage and frequency.

The control system has been installed in a sulfur dioxide solvent extraction plant at the Llandarcy refinery of the Anglo-Iranian Oil Co. and comprises 24 Eversheld controllers, 17 being concerned with liquid levels, four with flow and three with pressure.

KING PIN REMOVER

Chamberlain Industries, Ltd., Staffa Works, Leyton, London, has produced a heavy duty hydraulic king pin removing tool, designed to fit the axles of the majority of standard vehicles being operated today.

Basically, the equipment consists of a hydraulic pump incorporating the well-known "Staffa" principle, giving faster approach speed and easy working under pressure. This pump is connected by 7 feet of flexible hose to a single acting, spring-return hydraulic ram unit to which, in turn, is fitted the frame itself. The upper yoke of the press frame is threaded to accommodate the ram unit and also the tie-rods on which a substantial thread gives a wide adjustment of working depth. The hole in the center of the yoke is of 2" diameter, allowing the king pin or other fitting to pass through in the course of extraction. A force of 12 tons is exerted by the ram when the hydraulic pressure reaches 5,500 psi, and is sufficient to dislodge all but the most stubborn pins.

For periodic overhauls, pins may be removed in a matter of minutes, and attacks with hammers and wrenches, leading to damage, are a thing of the past.

INTEGRAL FURNACE UNIT

Babcock & Wilcox, Ltd., London, has developed the F. H. Integral Furnace Unit which is suitable for oil refinery work an account of its high efficiency, compact design, and suitability for installation in the open air, without necessitating large buildings.

Designed for oil, pulverized fuel, or gas firing, this boiler utilizes a completely water cooled furnace enclosed within the outer tube rows, and a system of baffling which causes the furnace gases to traverse the superheater and the remaining generator tubes in three horizontal passes before leaving for the economizer or air heater.

ALL-WELDED DRILLING BOILER

Ruston & Hornsby, Ltd., Lincoln, has developed an all-welded drilling boiler which is made in sizes up to 150 hp and for working pressure of 350 psi. The design is in accordance with the ASME code, and the electrically welded seams, which are in tension, are subjected to X-ray examination and are stress-relieved in a special furnace after welding has been completed.

The heating surface of the boilers is calculated on the API rating of 10 square feet of fire-touched heating surface per horsepower, so heavy overloads can be maintained.

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BRITISH OIL NEWS

By E. Lawson Lomax

It has recently been announced by the Iraq Petroleum Co. that deliveries from the Kirkuk field have, for the first time in the company's 25 years, exceeded one million tons per month, having reached 1,013,404 long tons for the month of April.

This is the result of the 30/32 inch pipe line from Kirkuk to Banias, Syria, coming into operation on April 9, and this record should be broken regularly for the next few months until full transportation through this line comes into operation.

With increasing production from Kuwait and other Middle East fields, it would appear that the present and projected refineries in the United Kingdom can readily be fully supplied by Middle East crudes, thus reducing dollar expenditure on the country's petroleum requirements.

The oil strike in the USA has however served to show how dependent the United Kingdom is on supplies from America for certain of its requirements, particularly high octane aviation fuels, and to a lesser degree for kerosine, gas and diesel oils.

In the light of these facts, the efficient use of the catalytic plants now in operation, and the others building and due to start operation in the near future, assumes the greatest importance, for it is only by the aid of these plants and their auxiliaries that Britain can be rendered independent of overseas supplies for these products.

Another item of general interest in the industry has been an increase in prices of various petroleum products which has been authorized by the Ministry of Fuel and Power. These increases are based on the rise in ocean freight, road transport costs, rail freight charges and wages. Motor gasoline has been increased by ¼d. per gal., kerosine by ¾d. per gal., automotive diesel oil by ⅜d. per gal., tractor kerosine by ½d per gal., and fuel oil ⅜d. per gal. These, however, are minor advances compared with the large increase in duty levied in this year's budget.

Tanker Launching

Overseas Tankship (U.K.) Ltd., Caltex group affiliate, announced in London the successful launching of the SS "Caltex Liverpool," fifth ship to be launched under the program for the construction in the United Kingdom of eleven tankers. The launching ceremony took place under sponsorship of Mrs. Howard M. Herron, wife of the chairman of the executive committee and director of the Caltex group of companies.

The vessel, built by R. & W. Hawthorn, Leslie & Co., Ltd. of Hebburn-on-Tyne, is 544' in length, 70' beam, and has a deadweight tonnage of approximately 17,250. It is powered by a 7,300 Shp steam turbine and will have a trial speed of 15 knots.

New Anglo-U.S. Asbestos Project

A new company, Marinite, Ltd., has been formed by The Cape Asbestos Co., Ltd., and the Johns-Manville Corp. of New York for the production of Marinite, a fire-proof boarding used in the joining side of ship construction. The capital of the new company is £500,000, of which Cape Asbestos is taking 53 percent and Johns-Manville 47 percent. A factory has been acquired at Gerniston, Glasgow, and machinery is now being installed for production.

The material is a non-combustible pressed asbestos board, weighing about 35 lbs. per cub. foot. It has a high insulation value, both for sound and temperature, is moisture resistant and has a high strength factor.

Marine Crank Case Explosion Preventer

A new method of preventing damage from explosion in the crank cases of ships' engines has been developed by John Lamb, head of the Shell marine research and development department. While it is impossible to prevent these explosions entirely, yet the results of tests have shown that by the provision of a newly designed relief valve which opens and closes instantly, injuries to personnel and damage to property can be largely minimized.

Personnel

N. B. Fuller, general manager since 1945 of the western markets division of AIOC's distribution department, has retired for reasons of health. He joined the staff of the British Petroleum Co. shortly after World War I, and served for several years as manager and director of Anglo-Iranian's Belgian and French associates before being transferred to London in 1936. Since World War II he has had general direction of the company's European and Pacific operations.

N. B. Fuller

Following the relinquishment by Commander Sir Robert Micklem of his offices in the Vickers organization and his subsequent death in May last, the following appointments have been made by the company: Sir James Reid Joung, chairman; Maj.-Gen. C. A. L. Dunphie, managing director of engineering works and shipyards; and E. I. Waddinton, director of administration. Maj. Sir Hew Kilner continues as deputy chairman and managing director of aviation.

H. D. Demoulins, member of the Esso Petroleum Company's board of directors, who rendered valuable services, particularly in the coordination planning of the Fawley refinery, has retired at his own request. He had been in the service of the Esso group for 31 years.

Fueling the "Comet"

John I. Thornycroft & Co. Ltd., along with Thompson Bros. (Bilston), Ltd., has developed "Thornet" fueling tankers for high speed fueling of the world's first jet airliner, the BOAC de Havilland Comet.

These fuelers are based on the Thornycroft "Sturdy Star" gasoline engined chassis, fitted with a high pressure pumping unit and split transmission power take-off by Thompson Bros. A fifth wheel attachment has been provided at the rear of the tractor chassis to enable it to be hitched to a semi-trailer tank unit.

Company Reports

A deduction of all charges (including additional depreciation of £22,053,608 against £7,059,696 in 1950), leaves the Royal Dutch Shell group net income available for appropriation in 1951 at £66,216,204 (£50,994,529 in 1950). Out of this, £19,057,327 (£16,283,382 in 1950) is paid to Shell Transport & Trading Co. which has declared a final dividend for 1951 of 1s.6d. per £1. unit with a bonus of 6d. per unit, both tax free, making a total distribution for the year of 3s. per unit equal to 15 percent net (12½ percent in 1950). Net revenue for the year was £7,399,129 (£6,438,477 in 1950); transfer to general reserve £500,000; carried forward, £2,683,309 (£2,748,027 in 1950).

Accounts of the Anglo-Iranian Oil Co. for 1951 have been prepared on the same basis as for 1950, figures for current liabilities and assets in Persia having had to be estimated to a certain extent. In estimating the profit for the year, royalty amounting to £8,326,446 has been charged on the basis of the 1933 convention with Persia, and after setting aside £9,500,000 to the special contingencies account.

	1951	1950
Gross profit	£75,899,965	£118,661,714
Royalties, depreciation, contingencies, etc.	23,683,949	34,195,372
U.K. taxes	27,373,901	50,706,880
Net profit	24,843,115	53,759,462
Preference dividends	1,071,234	1,071,234
Ordinary dividends	6,041,250	6,041,250
Preference stock reserve	1,000,000	1,000,000
General reserve	16,000,000	25,000,000
Carried forward	1,996,624	1,876,058

The total dividend has been maintained at 30 percent.

The Manchester Oil Refinery's need for more working capital has been supplied by a temporary unsecured loan now amounting to £100,000 pending the provision of long term finance, so it is proposed to increase the ordinary share capital of £500,000 (in 5/ units) to £750,000 by making a share issue in the near future to complete plant expansion and increase output. Final dividend is 10 percent, making 20 percent for the year, the same as last year on a smaller capital.

The Antwerp refinery of Petrofina is operating at a rate of 2,000,000 tons per year and extensions are contemplated. A new company has been formed to sell liquid gas produced in the refinery under the trade name "Petro-gas." Net profit for the parent company for 1951, after charging Frs. 34.6 million amortization, Fr. 45 million taxation, and writing off capital increase expenses, was Fr. 242 million (Fr. 140 = £1). The dividend is increased to Frs. 80 per share (Frs. 70 in 1950).

United British Oilfields of Trinidad reports depreciation charges of £583,320 (£530,578 in 1950) and allotment of £1,016,000 for U.K. and Trinidad taxation (£1,057,500 in 1950) leaving net revenue for the year of £1,077,038 (£1,115,574 in 1950). Dividend on the ordinary stock is again 12 percent tax free, absorbing £187,500. Transfer to general reserve is £875,000 as against £780,000 in 1950, when £125,000 was also provided against deferred liability to income tax.

Crude oil production was 5.4 million barrels (5.5 million barrels in 1950). Refinery throughput, including purchased oil, was 9.1 million barrels against 8.9 million barrels in 1950.

WINDOW ON THE FUTURE

A great new oil refinery with a projected capacity of 80,000 barrels a day is being erected by Anglo-Iranian on the coast of Kent, at a cost of some $112,000,000. By 1953 the Company's four home refineries will have a combined daily throughput of over 200,000 barrels—which will be the largest contribution to the country's total refining capacity of some 520,000 barrels a day

In many other countries the refineries operated by Anglo-Iranian and its associated companies are increasingly contributing to the world's supply of petroleum products.

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Ethyl To Build Plant At Houston

Completion of a new, streamlined plant for the manufacture of "Ethyl" antiknock compound has been announced by E. L. Shea, president of Ethyl Corp. The plant will provide a major increase in the nation's tetraethyl lead capacity and "incorporates many technological improvements, process changes and new engineering designs developed as a result of Ethyl's long experience in the field of antiknock compounds," Mr. Shea said.

With its Baton Rouge manufacturing plant, which is the world's largest, Ethyl now has two separate plants completely integrated and completely independent of each other.

The new plant is situated along the south bank of the Houston Ship Channel about 17 miles from downtown Houston. The entire plant area embraces approximately 400 acres. The present buildings cover about 80 acres, leaving substantial room for further growth, according to the announcement.

"Completion of our new plant at Houston," Mr. Shea declared, "marks a major milestone in the growth and utilization of 'Ethyl' antiknock compound. Not only does it mean an important increase in Ethyl's ability to meet the oil industry's requirements for antiknock compounds. It also means renewed assurance that the oil industry will be able to provide gasoline of adequate antiknock quality for the nation's needs in war or in peace. We take particular pride, at this time, in the completion of a new and strategically located center for the manufacture of antiknock compounds."

Ethyl's new Houston plant, like the Baton Rouge installation, will provide its own requirements of the new chemical intermediates needed in tetraethyl lead manufacture. Because of the diversity of operations required in the manufacture of antiknock compound, the plant is divided into three broad operating areas—the sodium area, the ethyl chloride area, and the tetraethyl lead area. The plant also has a modern administration building, a centralized shops and stores area, a utilities area, and other auxiliary features.

The largest structure in the plant is the T-shaped sodium building, where salt is electrolytically decomposed into sodium and chlorine. In one section of the building, incoming salt brine is evaporated, filtered, and dried prior to being decomposed. The other section contains the cell room, where the salt is electrolysed. Already the world's largest producer of sodium, Ethyl is obtaining a broad increase in capacity with its new Houston installation.

In the ethyl chloride area, the first unit to participate in the process is the hydrogen chloride plant, where hydrogen is burned with chlorine obtained from the sodium operations. The resulting hydrogen chloride is then compressed and sent to the ethyl chloride unit, where it is reacted with ethylene to form ethyl chloride. Another unit in this area is the ethylene dichloride plant, where ethylene is added to chlorine to form ethylene dichloride.

As with the sodium plant, the new ethyl chloride facilities represent an important addition to Ethyl's capacity for this tetraethyl lead intermediate. The new unit, moreover, incorporates a number of design improvements resulting in more efficient and simplified operations.

In the tetraethyl lead area, the principal structure is the tetraethyl lead plant, where both the alloying and the tetraethyl lead operations are carried on. As a first step, metallic lead is reduced to its molten state. This molten lead is then combined with molten sodium to form the alloy which participates with ethyl chloride in the tetraethyl lead reaction.

The tetraethyl lead section of the building is four stories high. The manufacturing operation begins on the fourth floor, where the lead-sodium alloy and the ethyl chloride are introduced. After the basic reaction has been completed, the tetraethyl lead is washed and purified and then blended with other ingredients to form the finished antiknock compound.

Typical of the scope of the plant's operations is the fact that it consumes as much electricity as a city of 100,000 people. To handle this electrical load, the plant has its own power substation with 28 heavy-duty transformers able to handle incoming current of up to 66,000 volts.

Other features of the plant include a separate utilities area containing the plant's own refrigeration and steam-generating facilities; a centralized shops and stores area for handling all of the plant's maintenance requirements; and a laboratory with elaborate analytical equipment for the quality control of all products. The plant also has extensive storage facilities for "Ethyl" antiknock compound, sodium, chlorine, and ethyl chloride. There are four miles of roads and streets in the Ethyl plant and six-and-a-quarter miles of railroad track.

Ethyl is increasing its fleet of railroad tank cars to handle the additional production of its new Houston plant. Including cars on order, it will have a total of over 400 tank cars for the shipment of "Ethyl" antiknock compound and another 130 cars for transporting sodium, chlorine, and ethyl chloride. All shipments from the Houston plant will be handled by railroad tank car. The plant is served by the Port Terminal Railroad, which in turn serves all six railroad lines entering Houston.

The plant will obtain its raw material requirements, for the most part, from nearby sources. The principal exception is metallic lead, which is purchased from domestic and foreign producers.

About 1,000 people will be employed when the plant reaches full-scale production.

Edward Valves Names Foley Ad Manager

Edward Valves, Inc., announces the appointment of Joseph E. Foley, Jr. as manager of sales promotion and advertising. Mr. Foley, formerly a division advertising manager for the American Brake Shoe Co., and before that account executive with A. E. Aldridge Associates, will be in charge of all advertising and promotional activities of Edward Valves, subsidiary of the Rockwell Corp.

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Oil Industry Facing $8 Billion Outlay

Addressing the annual meeting of the Empire State Petroleum Association on May 14, A. Swensrud, president of Gulf Oil Corp., declared that the greatest problem facing the oil industry today is that of finding funds with which to finance necessary capital expenditures while still paying reasonable dividends to stockholders and preserving the financial safety of the companies.

"Since V-J Day," Mr. Swensrud said, "the oil industry in the United States has found it necessary to invest well over $15 billion for expansion, replacements, and improvements. You might think that the job was about done. However, if the expansion program considered by the Petroleum Administration for Defense to be essential over the next 18 months is to be carried out, the industry will find itself with an additional expansion bill totaling more than $8 billion between now and the end of next year. In addition, the oil industry is now furnishing larger quantities of materials for the chemical industry, the capital cost of which is not included in these figures."

Mr. Swensrud expressed the belief that the industry can come through with the needed program unless it is hampered by shortages of materials, by burdensome government regulations, or by restriction of the profits needed for expansion. Of the three, he said, restriction of profits probably looms as the most serious danger.

"Higher and higher taxes. in many cases almost confiscatory, have reduced the amounts of money investors have available," he said. "If an industry such as ours is to expand its facilities and keep pace with the nation's requirements and at the same time preserve reasonable financial safety, it must be done primarily from the reinvestment of earnings."

Rise In Gasoline Consumption

Domestic demand for gasoline in 1951 rose more than eight percent for the second consecutive year, the American Petroleum Institute reports. The increase was 8.05 percent over 1950. It reached an all-time high total of 43,888,727,000 gallons, more than three billion gallons above the 40,617,285,000 gallons consumed the previous year.

Record consumption of motor fuel coincided with a sharp rise in automobile registrations. These jumped 6.3 percent in 1951 to a total of 42,846,000 estimated by the Bureau of Public Roads. The preliminary Bureau estimate indicates that truck and bus registrations rose 5.9 percent to 9,343,000.

The top three gasoline-consuming states retained 1949 and 1950 positions. California was first with 4,390,157,000 gallons, Texas came next with 3,514,073,000. New York stood third with 2,787,670,000. Illinois, Michigan, Ohio and Pennsylvania also were in the over two billion gallons class.

Peak gasoline consumption came in August, when 4,132,290,000 gallons were bought. October and July ranked second and third, respectively.

Gasoline production in the United States passed the billion barrel point for the second straight year in 1951. It totalled 1,139,511,000 barrels, or 47,859,462,000 gallons, and accounted for 42 percent of all petroleum products refined last year.

Book Review

Summary of Water Flooding Operations in Illinois to 1951; published by Interstate Oil Compact Commission, Oklahoma City, Okla.

This report summarizes the results of flooding operations in 1950, when 32 new projects were brought into operation, raising the total to 63. Three of the floods are selected for detailed description. Since the beginning, these floods, together with many McClosky dump floods, have produced more than 20 million barrels of oil. This oil was obtained from sands averaging 18 feet thick, with average porosities of 18 percent and permeabilities averaging 176 millidarcys. Initial fluid saturations averaged 45 percent oil and 31 percent water. Ratio of water input to oil produced was about 7 to 1 at the end of 1951.

Corrosion Resistant Valve Bulletin

A new thirty-five page service bulletin describing types, sizes, operation, and features of Rockwell-built Nordstrom corrosion resistant valves has been issued by Rockwell Manufacturing Co. Over 100 photographs, sectional drawings, and dimensional drawings illustrate valve sizes, types, and practical applications. A special section is devoted to Nordstrom lubricants and lubricant equipment. In addition, information is given on Edward heavy-duty instrument and gauge valves manufactured by Edward Valves, Inc., of Rockwell Manufacturing Co. Added information is also given about Rockwell remote registration, industrial meters, Rotocycle meters, and water meters. Write for Bulletin V-217, Rockwell Manufacturing Co., 400 N. Lexington Ave., Pittsburgh 8, Penna.

Sucker Rod Research

A three-year study of the technology of sucker-rod pumping systems has been begun at Battelle Memorial Institute, Columbus, Ohio, under the direction of a steering committee. Members are: L. A. Little, Lufkin Foundry and Machine Co., Lufkin, Texas; J. R. Mahan, National Supply Co., Toledo, Ohio; L. A. Ogden, The Pure Oil Co., Tulsa; and H. H. Kavaler, Phillips Petroleum Co., Bartlesville, Okla., chairman.

The pivotal product of the pending three-year study is an analog computor, or "simulator," that will be equivalent to the entire sucker-rod system. All measurable factors (energy input, volume lifted, etc.) will be sent into this simulator and unknown factors determined with reference to any well being pumped or scheduled to go on pump.

INTERNATIONAL NEWS AND NOTES

Peace River Reserves Claimed Adequate for Pipe Line

Gas reserves in the Peace River area of British Columbia and Alberta are now considered more than enough to supply a gas line leading to Vancouver and the Pacific Northwest area of the United States. Pacific Petroleums Ltd., which has 3,301,292 acres in British Columbia for development, says that gas sales to the pipe line may start in the winter of 1953.

Most of the Pacific acreage is in the Peace River area around Fort St. John where wells have found five gas-bearing zones, appreciable amounts of clear naphtha, and oil showings are "in the process of evaluation." British Columbia, Washington and Oregon will have an abundant supply of natural gas from the 13 million acres in Alberta and 25 million in British Columbia. Westcoast Transmission Company, Ltd., the firm that will build the proposed pipe line, has separate applications pending before the Board of Transport Commissioners at Ottawa and the U. S. Federal Power Commission.

Latest gas discovery to add to reserves in northeast British Columbia is Pacific St. John No. 6, two miles west of gasser No. 4 and four northwest of the discovery well. Number 6 ran two drillstem tests in the middle Triassic zone and brought up gas totaling 2,498,000 cubic feet daily and substantial naphtha.

First test at 4,908 to 4,928 feet gave gas increasing to 1,650,000 cubic feet in 90 minutes and a strong naphtha spray.

Gas has also been discovered for the first time in the southeast portion of British Columbia in the Flathead Valley area. A moderate flow of gas in an unidentified sand section was made by Pacific Petroleum drillers on land leased by Amalgamated Oil. This brings the total discoveries in British Columbia up to eight in 1952, seven gas strikes and one oil find.

Pacific Pete plans another exploratory well in the Pouce Coupe-Fort St. John area south of main Fort St. John drillings. The new wildcat will test down to and including the Permo-Pennsylvanian formation.

At Fort St. John No. 4 drillers were in the Permo-Pennsylvanian formation at 6,349 feet, 55 feet above the top of the same formation in the discovery well Fort St. John No. 1. After finding the formation tight at interval 6,279 to 6,310, the well is searching for more porosity. About 40 feet of fairly tight formation has been penetrated below the gas cap.

Pipe line engineers for the Westcoast Transmission Co. recently completed a land survey of the company's pipe line route. George Phillips, engineer with Ford, Bacon and Davis Ltd., retained by Westcoast, said no difficulties were foreseen anywhere along the route. He said the entire route is accessible by good roads and rail lines.

Additional contracts have been let for materials for the Trans Mountain Oil Pipe Line Company's line now under construction from Edmonton to Vancouver. Canadian Bechtel, agent for Trans Mountain, has let the following contracts:

Grinnell Co. of Canada, Ltd., for 2,500 feet of 16-inch pipe and 200 feet of ten-inch pipe; Crane Ltd., 2,500 feet of 16-inch pipe, 300 feet of ten-inch and 40 four-inch cast carbon steel gate valves; Fleck Brothers, pipe material; Alcock Downing and Wright, small diameter pipe and welding fittings; G. S. Eldridge and Co., Ltd., water testing for cooling and domestic water supply at Kamloops pump station; and Engineering Drilling for taking soil samples for analysis at the Burnaby tank farm and Kamloops pump station. All are Vancouver firms. Guelph Engineering of Guelph, Ontario, will supply twenty 24-inch gate valves.

Sale of 80 acres of municipal land on Burnaby Mountain to Trans Mountain Oil Pipe Line Co. for $28,575 was approved by the Burnaby council. An agreement by which the company is to pay $33,000 for servicing of the property was also approved by the council.

This summer will see the search for oil in Canada spread to the far north with British American Oil Co., Ltd. and the Hudson's Bay Gas and Oil Co., Ltd. exploring 1,800,000 acres in the Northwest Territories. Exploration permits have been received for land near the junction of the Liard and McKenzie Rivers. Several million more acres have been staked, but final approval is still awaited from Ottawa.

A core drilling program is scheduled this summer along with studies by geological field and survey parties. These will be supplied by helicopter from Port Simpson.

To Direct Indian Refinery

William A. Williams of Montreal, oil refining expert whose background includes 18 years experience in the Canadian petroleum industry, has been selected by Standard-Vacuum Oil Co. to direct its refining activities in India. The company announced today that Mr. Williams has been appointed chairman and managing director of a new subsidiary now being formed to build and operate Stanvac's new $35 million refinery at Bombay.

W. A. Williams

Mr. Williams has been superintendent of Imperial Oil Limited's Montreal refinery for the past two years. He began his petroleum industry career in the laboratory at Imperial's Sarnia, Ontario, refinery in 1934. Thereafter he served successively as senior process engineer, manager of the technical service department, and assistant superintendent in charge of process operations at the Sarnia plant prior to his transfer to Montreal in 1950. He served in the Canadian Navy and at the time of his discharge in 1945 was a lieutenant-commander in charge of the Petroleum Products Supply Department at headquarters in Ottawa.

Mexico Invites U.S. Cooperation

Speaking before the May meeting of the Interstate Oil Compact Commission at Phoenix, Arizona, Senator Antonio J. Bermudez, director general of Petroleos Mexicanos, said that it was Mexico's desire to apply to its petroleum operations the same conservation principles which have been adopted in the United States.

Senator Bermudez invited United States oilmen to come to Mexico. In outlining Mexico's plans to drill a minimum of 176 exploratory wells in 1952, the largest number of its history, he said, "Independent contractors from the United States are helping in our program, and they are operating successfully. There are many of these men who are living testimony to the fact that the conditions which we offer them are satisfactory and attractive."

Mexico has been particularly fortunate in finding new reserves of natural gas, the Mexican oil head stated, since there are ten fields in northern Mexico, two of them major fields, and the country will have not only sufficient supplies to meet domestic requirements, but also a sizeable surplus for export.

Cyanamid Forms Canadian Subsidiary

Chemical Construction (Inter-American) Ltd. has been formed as a subsidiary of American Cyanamid Co. with main offices in Toronto, Canada, to design and build chemical plants in all nations of the Western Hemisphere except the United States. Its operation will parallel those of another Cyanamid unit, Chemical Construction Corp., which designs and builds chemical plants in the United States and throughout the world. President of the new company is W. R. Geddes, assistant to the president of North American Cyanamid Ltd., which is wholly-owned by American Cyanamid Co.

Bahia Construction Starts

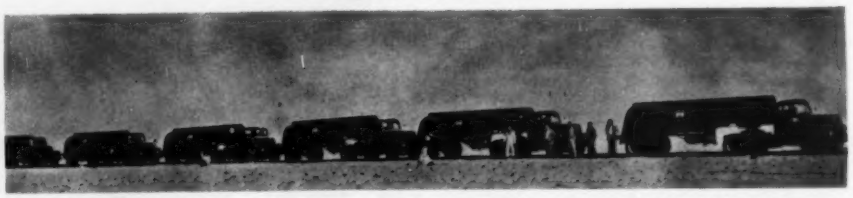
Construction has started on the expansion of Brazil's first modern refinery, completed in 1950 at Mataripe in the State of Bahia, according to an announcement by The M. W. Kellogg Co. which designed both the new and original facilities. Kellogg Pan American Corp. is supervising construction.

The expansion will double the capacity of the present 2,500 b/d combination thermal refinery. The completed plant will include topping, visbreaking, thermal reforming and cracking stabilization, and light ends recovery, in addition to the cat poly, caustic treating and LPG facilities.

Sun Shifts Refinery Site

Sun Oil Company, Ltd., has sold its 125-acre refinery site to Dow Chemical of Canada, Ltd., and at the same time has purchased from Dow a 200-acre site immediately south of the present property. Dow bought the Sun site in order to acquire property adjacent to its plant along the St. Clair River. Sun will use the newly-acquired property for the refinery announced last year. Clearing of the Sun refinery site has begun and construction start is scheduled soon. It is expected that the refinery will be completed in about 15 months.

Trucks for Desert Service



A fleet of International Trucks hauling 3,600-gallon semi-trailer tanks in Egypt halts briefly on a desert highway. These six are part of 75 units operated by the Egyptian government for fuel transportation. The tanks have 200 gallon-per-minute pumps driven by power takeoffs from the truck transmission.

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THE Air Motor "Skatoskalo" Set enables the operators to descale and clean tubes in the shortest possible time with the greatest efficiency. The air motor gives more horse-power and does not stall when heavy deposit is encountered.

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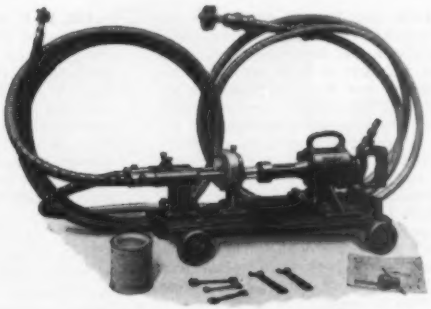
"Skatoskalo" equipment can be used with complete safety and is recommended for the efficient maintenance of cracking plant, boilers, evaporators, condensers, heat exchangers, etc.

Tubes of 5/8" internal dia. upwards can be thoroughly cleaned by "Skatoskalo" Air Tools.



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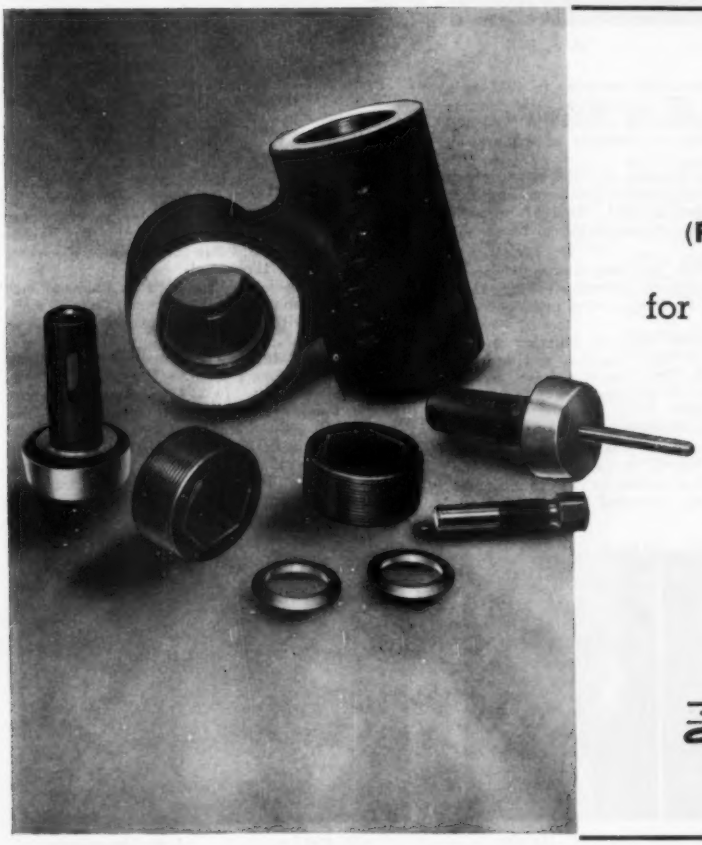

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OIL COMPANY STAFF CHANGES

D. G. **KINGMAN**, San Joaquin division superintendent of General Petroleum Corporation's production department, has been advanced to the post of assistant manager of joint venture operations. Mr. Kingman has spent fourteen of his nearly twenty years' petroleum experience with General Petroleum in the San Joaquin region. He was successively a production foreman, a production engineer, assistant to division superintendent, and production superintendent before becoming division superintendent in 1944.

John J. Oliphant has been appointed superintendent, San Joaquin division of General Petroleum Corporation's production department, to succeed Mr. Kingman. Since 1948, Mr. Oliphant has been superintendent of the division. J. F. Bohns succeeds him in that position.

C. F. **McGOUGHRAN** has been elected secretary of Sinclair Oil Corp., succeeding O. M. Gerstung, who has retired. In addition to his duties as secretary, Mr. McGoughran will be director of personnel of Sinclair and its subsidiaries. Mr. McGoughran joined Sinclair in 1920 at the company's East Chicago refinery. In 1946, he was appointed executive assistant to the vice president in charge of marketing, and in 1949 was made general sales manager. In 1950, he was elected a vice president of Sinclair Refining.

WALTER G. BEACH, supervisor of publications for Humble Oil & Refining Co., has been elected president of the International Congress of Industrial Editors. Mr. Beach manages the production of five company publications, including *The Humble Way*, which has received several awards for outstanding excellence.

JAMES E. ALLISON has been elected president of Warren Petroleum Corp. and D. L. Connelly a vice president and director. At the same time W. K. Warren stepped up from the presidency to chairman and J. A. LaFortune became vice-chairman.

Mr. Warren has headed the company since it was founded in 1922. Mr. LaFortune joined Warren two years later as secretary and became vice president in 1929.

The new president of Warren has been a vice president, general counsel and a director since 1946 when the Hanlon Companies were purchased. He had represented the Hanlon interests as counsel since the early twenties.

Mr. Connelly has been president of Warren Oil Corp., producing subsidiary. He also is a veteran in Mid-Continent oil operations, having joined the old Gypsy Oil Co. as a scout in 1922. Later he joined Indian Territory Illuminating Oil Co. of which he was manager of the land and geological division when ITIO was merged with Cities Service. He headed the Cities Service land and geological operations in Texas at the time of his resignation in 1944.

DR. R. B. KILLINGSWORTH has been named manager of the technical department of Vacuum Oil Company, Ltd., London. He has been staff assistant in charge of special products, to William M. Holaday, director of Socony-Vacuum's laboratories. Dr. Killingsworth will assist in enlarging the existing technical organization to serve the British company's expanded operations. Socony-Vacuum and Powell Duffryn, Ltd., share the ownership of Vacuum, which expects to complete its new refinery at Coryton, England, early next year.

E. J. HAMNER has been appointed manager of Humble Oil & Refining Company's operations in California. John S. Bell was appointed assistant manager for California. Hunter Yarbrough is area geologist in direct charge of exploration matters and Lawrence H. Byrd is area production superintendent in charge of drilling and producing.

E. J. Hamner *J. S. Bell*

Mr. Hamner joined the company in 1932 as a truck driver and then roustabout. He became assistant chief geologist in Houston in 1946 and moved to California as manager of exploration in 1948.

Mr. Bell joined Humble in 1933 as a rotary helper and was made district petroleum engineer for Southwest Texas in 1934. In 1951 he came to California as district superintendent.

W. M. FLOWERS has been appointed president of Sinclair Research Laboratories, Inc., Harvey, Ill., and E. J. Martin vice president and general manager.

Mr. Flowers joined Sinclair Refining in the cracking division of their research and development department in 1928. He was named executive vice president of the research laboratories in May of last year.

Mr. Martin joined Sinclair in 1929. After about four years in Sinclair's cracking work in the development department, he was assigned to the lube research division, where he rose to assistant director before being promoted to his recent administrative post.

FREDERICK A. MYERS has been appointed gas advisor to the chief of the gas supply and disposition branch of Gulf Oil Corporation's production department.

In this new assignment, Mr. Myers will assemble, maintain, and develop current information on available and potential gas markets and the transportation of natural gas through personal investigation, as well as by means of the analysis of reports.

Gulf also announces that Alfred M. Houghton has relinquished his duties as patent counsel, but will continue in the employ of the Gulf Companies as consulting patent counsel. Horace B. Cooke will succeed Mr. Houghton as patent counsel, and Gordon A. Kessler has been appointed assistant patent counsel.

M. E. GRANT, manager of transportation and supplies for Shell Oil Co., will become executive vice president of Plantation Pipe Line Co., Atlanta, July 1. He will be succeeded by R. N. Duncan, manager of the supplies department. M. H. W. Dent, now assistant manager of supplies, will become manager in Mr. Duncan's place, and will be succeeded by C. M. D. Peters.

Mr. Grant is a graduate of the University of Missouri law school. He started work with Shell 22 years ago in St. Louis, was transferred to New York in 1940, and since has handled transportation and supply matters.

LLOYD TURNER, former financial editor of the Vancouver Sun, Vancouver, British Columbia, has joined Pacific Petroleums Westcoast Transmission Co. and associated companies. He will handle public relations. Pacific Petroleums is active in drilling and exploratory work in British Columbia and discovered the province's first oil well at Fort St. John last November. Westcoast Transmission plans to build a natural gas pipe line from the Peace River to serve Vancouver and the Pacific Northwest.

DONALD H. LEWIS has been named vice-president of Shell Pipe Line Corp. He joined the company in 1927, became chief engineer in 1939 and a director in 1942. Important construction projects carried out under his technical direction include the East Texas gathering system, the Ozark system, the Bayou system, the Rancho system and the Venezuelan Lightline, the latter four being "big inch" lines.

DAVID GRAHAM and **JOHN E. SWEARINGEN** have been elected directors of Standard Oil Co. (Ind.). Mr. Graham is financial vice president and Mr. Swearingen is general manager of production for the company. Mr. Swearingen at the age of 33 is the youngest executive ever elected to the board.

Mr. Graham joined Standard as financial vice president January 1, 1952, coming from a similar position with the Weyerhaeuser Timber Co. at Tacoma, Wash.

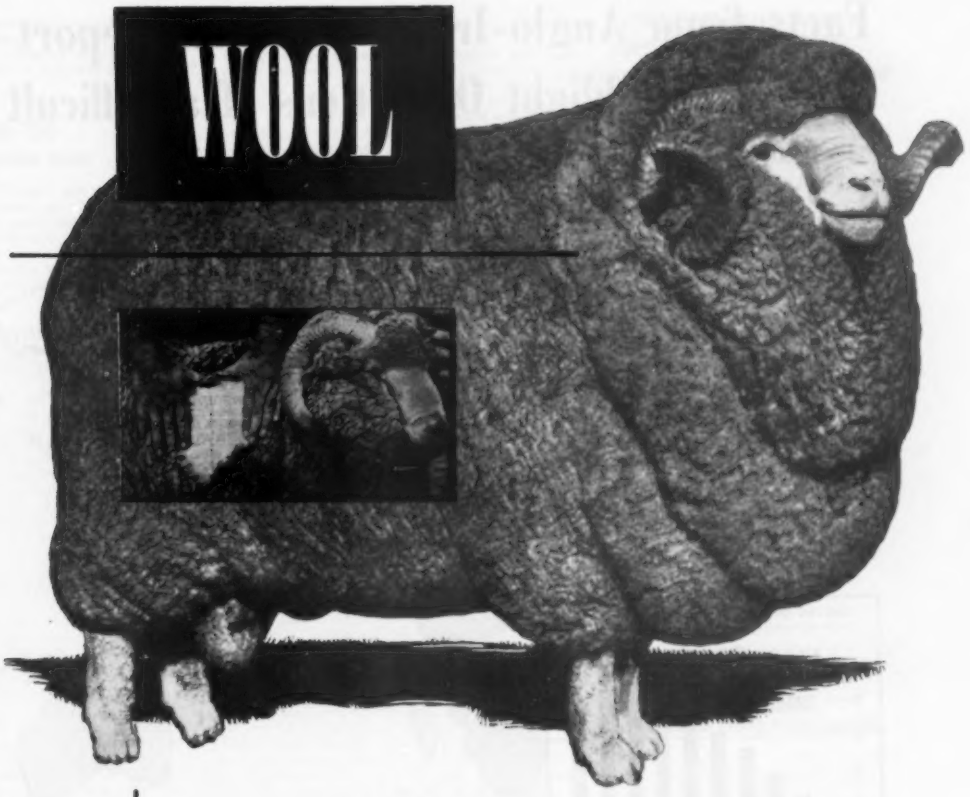
Mr. Swearingen joined Standard in 1939 as a chemical engineer in the Whiting, Ind., research laboratories. In 1947 he was transferred to the manufacturing department of Stanolind Oil and Gas Co. He became assistant to the vice president in charge of operations in 1949 and manager of the company's central division a year later. He was brought to Chicago in August, 1951 as Standard's general manager of production.

J. E. Allison *D. L. Connelly*

W. M. Flowers *E. J. Martin*

D. Graham *J. E. Swearingen*

WOOL



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protection and
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man, woman, child.

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AUSTRALIAN WOOL
means **fine** wool...
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1 out of every 4 pounds
of the world's supply...
more than half
of all the top-quality
Merino wool.

Wool is **one-third**
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accounts for **one-tenth**
of the national income.

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commodity
to Australians is
OIL...

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which have aided
industrial expansion...
which give power,
light, warmth...
which fuel and lubricate
all manner of
modern transport.

More than a **billion**
imperial gallons
of oil products
each year
are the **life-blood**
in the arteries of
the Australian Commonwealth...
are helping to build
a stronger nation...
a better way of life
for the Australian people.

In Australia, as elsewhere
in the Eastern Hemisphere,
people know
they can depend on
the Stanvac organization
to supply this vital oil.

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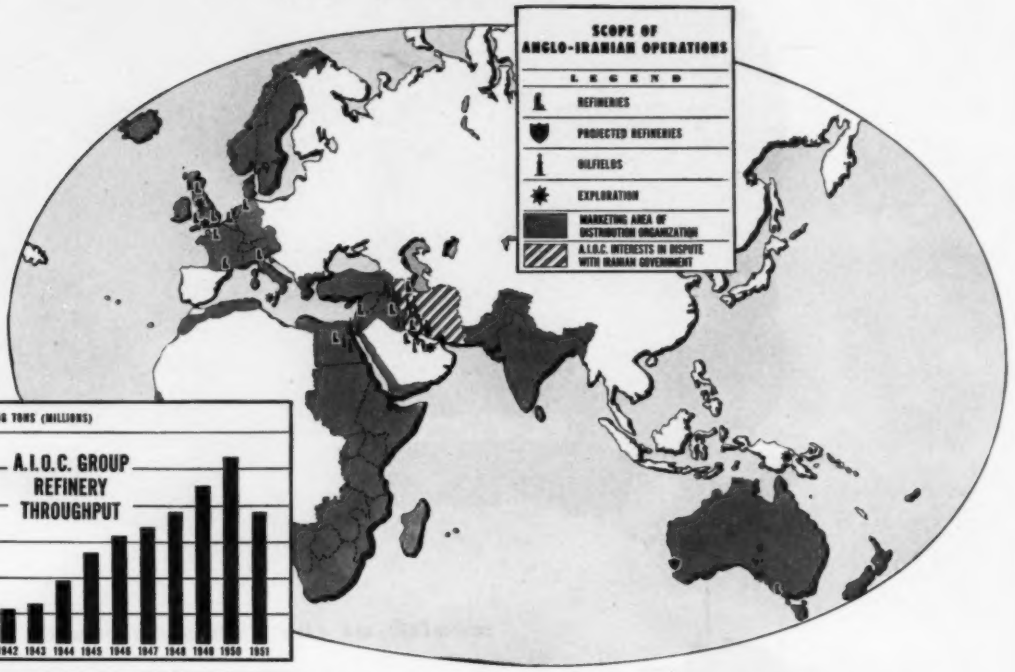
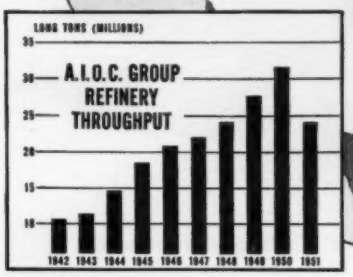
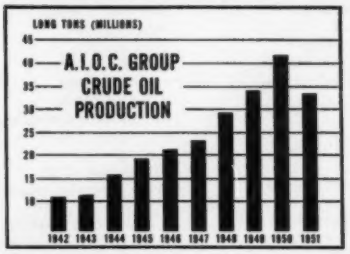
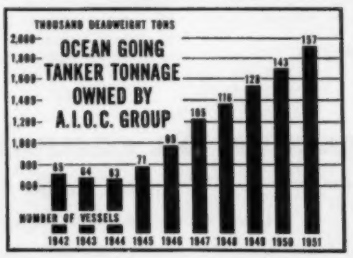
Facts from Anglo-Iranian Annual Report for 1951 Highlight Operations of a Difficult But Constructive Year








THOUSAND DEADWEIGHT TONS
OCEAN GOING TANKER TONNAGE OWNED BY A.I.O.C. GROUP
NUMBER OF VESSELS
63 64 63 71 93 105 116 128 143 157
1942 1943 1944 1945 1946 1947 1948 1949 1950 1951

Events in Iran in 1951 deprived Anglo-Iranian Oil Company Ltd.—and the rest of the world—of 116 million barrels of oil in the last half of the year. But Iran, despite its importance in oil production and refining output, represented only a portion of Anglo-Iranian's widespread operations in many parts of the world.

What the Company is doing to expand production, exploration and refining elsewhere is described in these highlights from the Chairman's Statement to Stockholders —a report of progress during Anglo-Iranian's toughest, but, in many respects, its most resourceful year.

Distribution and Sales

Although events in Iran deprived the Company of some 116 million barrels of supplies from that source, its sales for the year declined by only 15 million barrels from the 1950 total of 288.7 million barrels.

Largely increased supplies of crude oil from Kuwait, Iraq and Qatar have more than offset the discontinuance of crude oil exports from Iran.

The increased supply of refined products from Anglo-Iranian's refineries and from processing arrangements made with other refiners cannot, however, meet its marketing requirements. The Company will continue to supplement its own supplies of products by purchases where it can do so on satisfactory terms, thus using every endeavor to conserve both

BP

ANGLO-IRANIAN

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its good will and a sound trading position until such time as the provision of further refining facilities enables the Company once again to go forward and expand its business as in the past.

Expanded Crude Oil Production Outside Iran

Compared with 1950 there was an increase in 1951 of 140,000 barrels per day from the Company's share of production in Kuwait, Iraq and Qatar. During 1952 Anglo-Iranian's supplies from these three sources are expected to be about 534,000 barrels per day compared with 342,000 barrels per day in 1951.

Increased Exploration

The Company's exploration activities continue in various parts of the world . . . in Papua in partnership with American and Australian interests two deep wells were drilled . . . in Nigeria, where the Company is in partnership with the Shell group, the first deep well was started during the year . . . in Trinidad, Anglo-Iranian has a holding in Trinidad Northern Areas, Ltd., now preparing to make a seismic survey of the Gulf of Paria . . . and in Sicily, geological and geophysical work is being carried out in concession areas.

Refining Increased Outside Iran

The refinery throughput of the Anglo-Iranian group of companies declined from approximately 650,000 barrels a day in 1950 to 480,000 barrels a day in 1951, as the result of shutting down the Abadan refinery in Iran which had processed 91.5 million barrels of crude oil up to July, when operations ceased, as compared with 180 million barrels in 1950. The Company's refining operations in other countries were considerably expanded.

Capacities of its refineries in Great Britain, France, Italy, Belgium and Germany are being increased by 117,000 barrels a day during 1952. A new refinery is to be built in Australia with a capacity of 62,000 barrels a day.

Transport

The Company's tanker fleet numbers 155 ships of 1,950,000 deadweight tons. There remain under construction or on order 21 ships totalling 426,000 deadweight tons. Anglo-Iranian has on charter about 2,000,000 deadweight tons of shipping, more than half fixed for several years ahead.

Middle East Agreements

New agreements have been negotiated affecting the Company's principal interests in the Middle East other than Iran. Profits arising from operations within Iraq (where Anglo-Iranian has a 23¾% interest in the Iraq Petroleum Company group) will be shared equally with the Iraq Government. The Ruler of Kuwait will receive one half of the profits from the operations in his country of the Kuwait Oil Company, which Anglo-Iranian owns jointly with an American associate. These agreements follow the pattern now generally accepted for oil concession agreements in the Middle East.

World Bank Mediation in Iran

Efforts by the International Bank for Reconstruction and Development to assist in settling the differences between the British and Iranian governments and to set up a temporary management for the operation of Anglo-Iranian's Iranian oil properties resulted in failure to reach agreement with Iran. In its position as a neutral intermediary, the Bank was unable to accept the proposal of the Iranian government that it act for Iran's account. The Bank also felt that it would be inconsistent with the Bank's international character to agree to exclude British technicians from employment as demanded by the Iranian government. In addition, no conclusion was reached with Iran about the question of prices at which oil might be sold by the Bank. The Bank, however, informed both the Iranian and British governments that it would be ready to assist in working out any practical suggestion offering a reasonable prospect of success.

FINANCIAL SUMMARY for 1951

Profit Before United Kingdom Taxation.	£52,217,016
Net Profit After Taxes.	£24,233,050
Appropriations to Reserves	£17,000,000
Dividends in Respect of 1951	£ 7,112,484

(Including recommended final dividend)

Copies of the Annual Report and Accounts may be obtained from the Company's representative in U. S. A., Mr. W. D. Heath Eves, 610 Fifth Avenue, New York 20, N. Y.

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NATIONAL OIL REFINERIES, LIMITED.
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THE COMMONWEALTH OIL REFINERIES, LIMITED.
ISLAND EXPLORATION CO. PTY. LIMITED.

MALTA—BP MALTA, LIMITED.

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THE BRITISH PETROLEUM COMPANY OF NEW ZEALAND (SOUTH WEST PACIFIC), LIMITED.

NIGERIA—THE SHELL-D'ARCY PETROLEUM DEVELOPMENT CO., OF NIGERIA, LIMITED.

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ALGERIA—SOCIÉTÉ DES HUILES DE PÉTROLE BP D'ALGÉRIE S.A.

AUSTRIA—BP BENZIN UND PETROLEUM A.G.

BELGIUM—BP BELGIUM S.A.
ANGLO-BELGE DES PÉTROLES S.A.
SOCIÉTÉ INDUSTRIELLE BELGE DES PÉTROLES, S.A.

DENMARK—BP OLIE-KOMPAGNIET A/S

EGYPT—ANGLO-EGYPTIAN OILFIELDS, LIMITED.

FRANCE—SOCIÉTÉ GÉNÉRALE DES HUILES DE PÉTROLE BP S.A.

FRENCH WEST AFRICA—SOCIÉTÉ DES PÉTROLES BP D'AFRIQUE OCCIDENTALE.

GERMANY—BP BENZIN- UND PETROLEUM-G.m.b.H.

HOLLAND—BENZINE EN PETROLEUM HANDEL-MAATSCHAPPIJ, N.V.

ICELAND—BP A ISLANDI HLUTAFELAG.

ITALY—BRITANNICA PETROLI S.p.A.
INDUSTRIA RAFFINAZIONE OLII MINERALI.

MOROCCO—SOCIÉTÉ DES HUILES DE PÉTROLE BP DU MAROC S.A.

NORWAY—NORSK BRAENDSELOLJE A/S.

SWEDEN—SVENSKA BP OLJEAKTIEBOLAG.

SWITZERLAND—BP BENZIN UND PETROLEUM A.G.

TUNISIA—SOCIÉTÉ DES HUILES DE PÉTROLE BP DE TUNISIE S.A

CHARLES M. ROOD has been made division engineer of Sohio's southwestern transportation division. He will continue to make his headquarters in St. Louis in this new assignment.

C. H. WRIGHT has been elected chairman of Sunray Oil Corp. to succeed F. B. Parriott, retired. Mr. Wright has been president of the company for 25 years and has been an employee since 1920. He became general manager in 1923 and president in 1927. Mr. Parriott has been chairman since 1937. He was formerly president of Transcontinental Oil Co. and one of the organizers of Plymouth Oil Co. in 1923.

New president of Sunray is W. C. Whaley who recently was transferred to Tulsa from California where he had been vice president in charge of west coast operations. He has been an oil man since 1910. He was in charge of Barnsdall's California production when that company merged with Sunray in 1950.

Other company changes following the annual meeting include the election of W. L. Horner as vice president in charge of reservoir engineering and of L. W. Bennett as treasurer. R. L. Johnson, superintendent of the Sunray refinery at Duncan, Okla. is to be transferred to Tulsa as general manager of Oklahoma refinery and pipe line operations.

C. H. Wright

W. C. Whaley

R. Girdler

REYNOLDS GIRDLER has been appointed director of public relations and advertising for Sinclair Oil Corp. and associated companies. Widely known in the field of public relations and advertising, Mr. Girdler began his career with Doremus & Co. He later was an editor of *Time* magazine and a financial columnist for *Nation's Business*.

Prior to his association with the Sinclair organization, Mr. Girdler was for the past several years a vice president and account executive of Carl Byoir & Associates, public relations consultants.

R. D. TOWNSEND has been appointed assistant to the manager, Rocky Mountain operations, of the General Petroleum Corp., Casper, Wyo. He will act as general advisor to A. F. Barrett, manager. S. J. Tryon succeeds him as manager, land-contract department.

EARL W. RUSSELL has been elected an additional assistant secretary of Standard Oil Co. (Ind.). He has been administrative assistant in the office of President A. W. Peake. Mr. Russell joined Standard in 1928 as a clerk. He was promoted to administrative assistant in the president's office in 1946. He was a Navy officer for two years during World War II.

EUGENE L. DAVIS has joined National Petroleum Corp. at Calgary as projects manager. For the past three years he has been project manager for Arctic Contractors in developing the U. S. Navy Petroleum Reserve No. 4 in Alaska. Prior to that he was production superintendent for Signal Oil and Gas Co. in California.

D. T. SHAW has been appointed manager of the Philadelphia refinery of The Atlantic Refining Co. He joined Atlantic in 1929 in the research and development department and moved to the refinery in 1937, where he has served as assistant manager since 1945.

John S. Patchin was named assistant manager of the refinery. He has been superintendent of the refinery's mechanical department since 1950, and has served in various supervisory capacities since 1920.

D. T. Shaw

J. S. Patchin

The Wimpey Central Laboratory

has been responsible for site investigations for many oilfield development and refinery construction projects. This work has included exploratory borings and soil mechanics tests for foundations and harbour works, soil surveys for roads and pipelines, investigations of sources of constructional materials, development of special methods of building construction for hot climates, and corrosion problems with buried metals.

Site investigations in connection with the projects of major oil companies have been made at the Grangemouth, Coryton, and Ellesmere Port refineries, for oilfield development at Kuwait, Seria (Borneo) and Soengei Gerong (Sumatra), and for harbour and pipeline works in Aden, Syria, Iraq and Lebanon.

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in observing its 25th Anniversary of service to the petroleum and mining industries, is pleased to announce the wider availability of
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In contrast to these structural methods, RADOIL is a geophysical technique for the *direct* location of oil. Through the agency of radio waves, it provides a unique method of mapping directly the location, outline and depth of oil-saturated zones in any of the known forms of structural, stratigraphic and lithologic traps.

The RADOIL method is not intended to replace the structural methods of geophysical exploration. On the contrary, its chief usefulness begins where the other methods leave off. It is best employed where other techniques have predetermined the presence of geological conditions favorable for the accumulation of oil. When thus applied, RADOIL bridges the wide and often costly gap between a structural prospect and a worthwhile oil field. And it does this with a high degree of reliability.

RADOIL is available for domestic and foreign operations, through contract and licensing arrangements. Detailed information will be furnished on request. Inquire also about the RADORE method, an adaptation of RADOIL for use in locating ore deposits.

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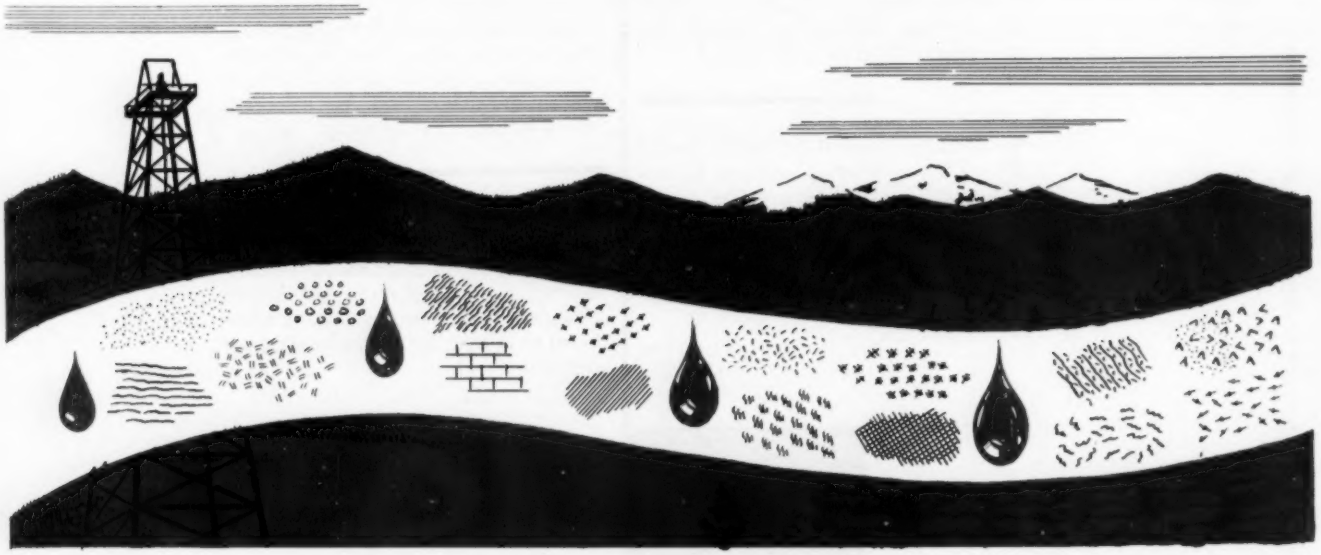
Wyatt Metal & Boiler Works Cover IV
Wallace Davis & Company

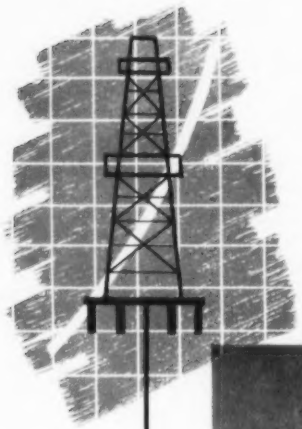
Youngstown Sheet & Tube Company 5
The Griswold-Eshleman Co.



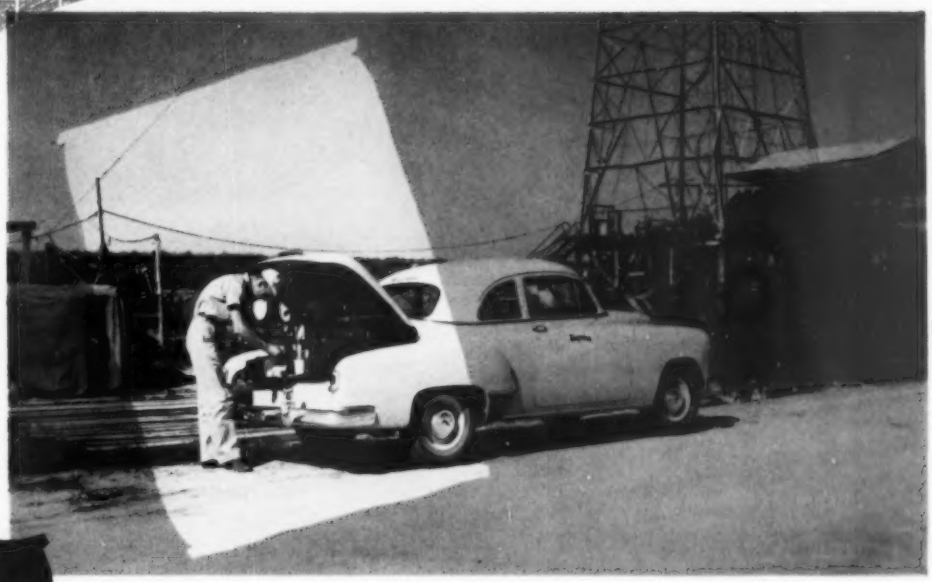
From The Ancient Seas of The Rockies . . .

THE ANCIENT SEAS OF THE ROCKIES — LONG BURIED BENEATH THE MOUNTAINS, VALLEYS, PLAINS AND PLATEAUS OF ONE-HALF OF THE POSSIBLE OIL-PRODUCING AREA OF THE NATION — REVEAL THEIR HIDDEN PETROLEUM WEALTH! The Estimated Proven Reserve, 1945: 447 Million Barrels! January 1, 1951: 1 BILLION 462 MILLION BARRELS! — Here, on the geological correlation charts, famous names of America's West, the Mesa Verde, Pictured Cliffs, Dakota, Sundance, Cody, Graneros, Kootenai, Mancos, Shinarump, Frontier, Tensleep, Minnelusa and many others, mark oil-producing formations in nearly every geologic age and spell modern opportunity in America's last great OIL FRONTIER, THE ROCKY MOUNTAIN REGION.

A FREE FOLDER and MAP, "Oil and Gas Fields of Rockies" yours on request. Petroleum Information, Continental Oil Bldg., Denver, Colorado and 315 North Wolcott St., Casper, Wyoming. Publishers, since 1928, of the Rocky Mountain Oil Information Service, Statistical reviews and data, Maps, sales headquarters for POMCO lease ownership maps, the Rocky Mountain Electric Well Log Exchange and Wyoming Geological Association Publications.



SINCE 1941 the average total drilling cost has increased more than 60%



YET THE COST OF DRILLING MUD IS STILL 20% BELOW THE 1941 LEVEL

Along with fair and reasonable prices, Magcobar has helped bring about other important advantages to the oil industry. Better service is an example. Today, Magcobar alone has more mud engineers in the field than the total of all mud companies in 1941. And, Magcobar has continually expanded and kept its service organization in tune with the needs of the industry. When you need mud, look for the "Magcobar, complete drilling mud service" sign in your area. Magcobar Dealers are ready to serve you night and day from Canada to the Gulf Coast.

Magcobar
Complete
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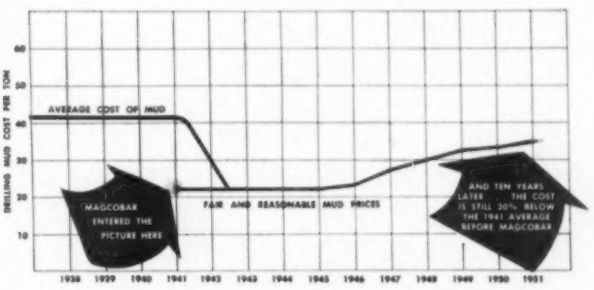
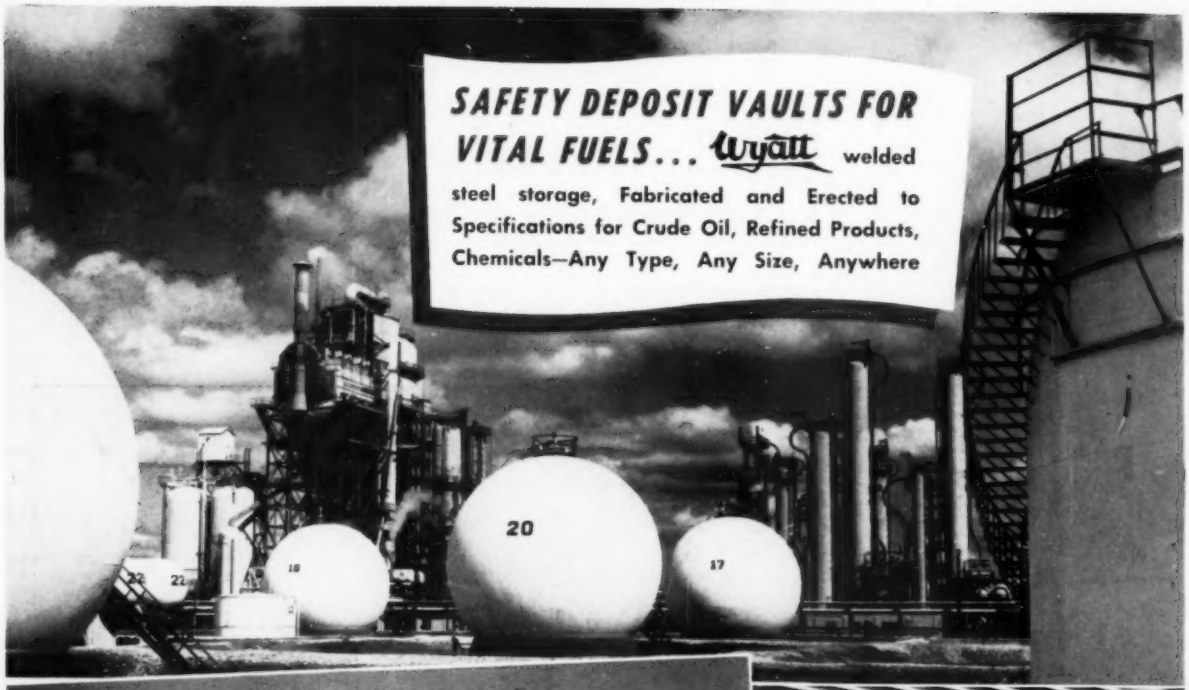
Magcobar • Magcogel • High Yield • Magco-Fiber • Xact Clay • Fiber Seal • Leather-Floc • Form-A-Plug • Cell-O-Seal Salt Gel • Magco-Phos • Red Ox • Magco-Mica • Tannathin Jel-Oil Mud • Jel-Oil "E" • "E" Concentrate • Noheev My-Lo-Jel Preservative • Quebracho • Chemicals

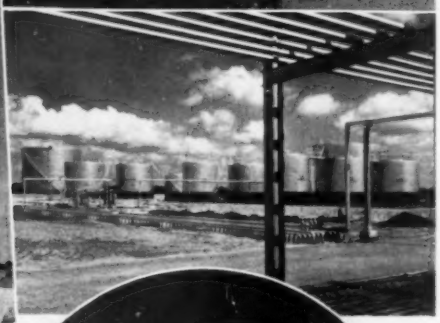

DRILLING MUD COST PER TON
AVERAGE COST OF MUD
MAGCOBAR ENTERED THE PICTURE HERE
FAIR AND REASONABLE MUD PRICES
AND TEN YEARS LATER — THE COST IS STILL 20% BELOW THE 1941 AVERAGE BEFORE MAGCOBAR
1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951

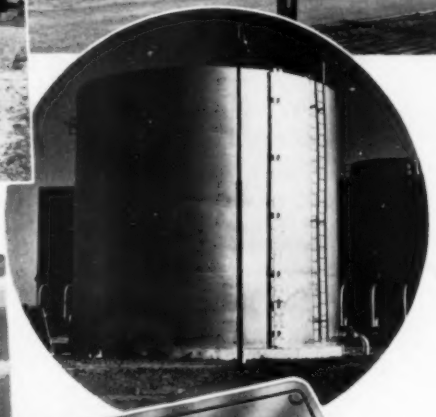
MAGNET COVE BARIUM CORP • MALVERN, ARK • HOUSTON, TEXAS

ONE OF THE DRESSER INDUSTRIES

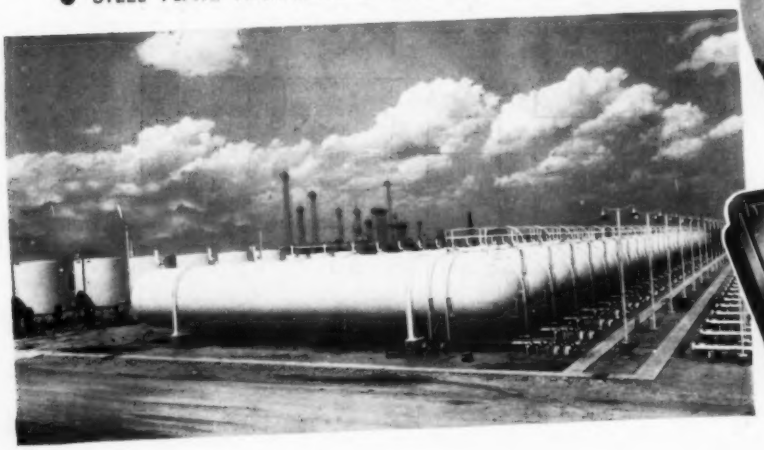


SAFETY DEPOSIT VAULTS FOR VITAL FUELS... Wyatt welded steel storage, Fabricated and Erected to Specifications for Crude Oil, Refined Products, Chemicals—Any Type, Any Size, Anywhere





● STEEL PLATE FABRICATORS AND ERECTORS SINCE 1913



Wyatt's
HOUSTON-DALLAS-NEW YORK-TULSA